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EVALUATION OF THE KENTUCKY WATER SUPPLY PROGRAM. DRINKING WATER

Bureau of Water Hygiene
Atlanta, Georgia

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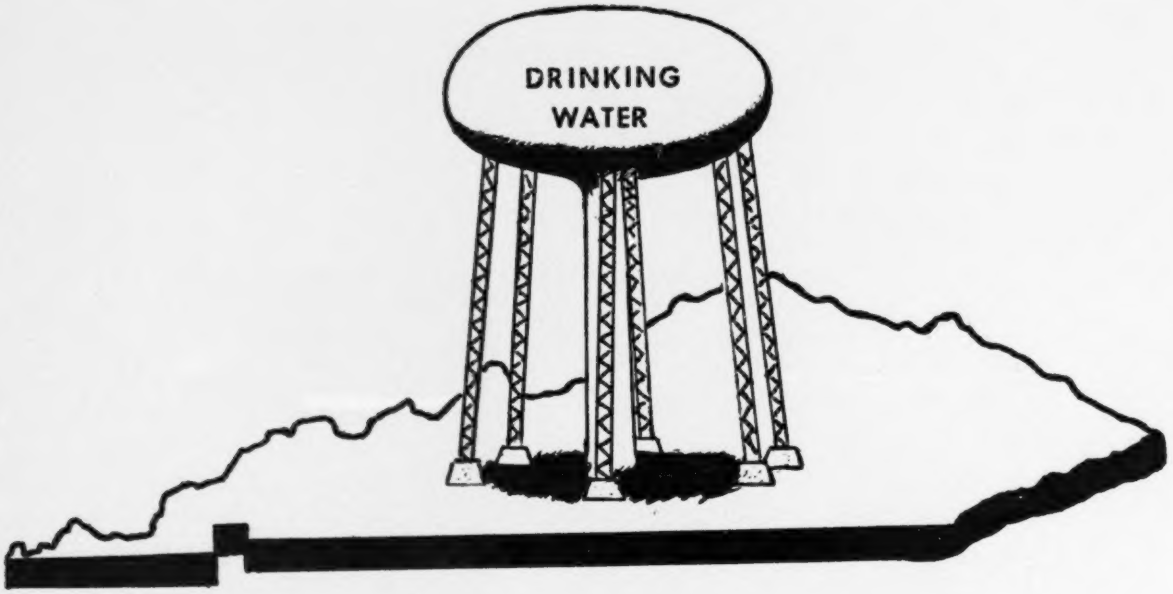
# of the
KENTUCKY WATER SUPPLY PROGRAM



Bureau of Water Hygiene

Environmental Protection Agency

Region IV

May 1972

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PREFACE

This report presents the Environmental Protection Agency's findings, conclusions, and recommendations with supporting data and explanatory text resulting from an evaluation of the Kentucky Drinking Water Supply Program.

The information contained herein is presented in condensed form and the significance is further discussed in a companion report EVALUATION OF THE KENTUCKY WATER SUPPLY PROGRAM - SUMMARY. The SUMMARY highlights important findings and principal needs for those who have an interest in Kentucky's drinking water but do not wish to study the details of the complete report.

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SUMMARY OF FINDINGS AND CONCLUSIONS

Recognizing that the health of over 3.2 million people in Kentucky is directly dependent upon the condition of their drinking water, Dr. William P. McElwain, Commissioner, Kentucky State Department of Health, requested that the Water Supply Section, Environmental Protection Agency, evaluate the Department's Water Supply Program. This report presents the Environmental Protection Agency's findings, conclusions, and recommendations, with supporting data and explanatory text of that evaluation.

Approximately two million people in Kentucky are served by 423 public water systems. Another 1.2 million rural residents obtain their drinking water from individual water systems. In addition, there are about 1,800 "semi-public" systems at restaurants, service stations, recreational facilities, schools, etc., and as many as 2.5 million residents and traveling public may be exposed to this water at one time or another during a year's time.

The effectiveness of the Kentucky Water Supply Program was judged primarily on the bases of drinking water quality, adequacy and condition of water system facilities, and water supply surveillance. Thirty-six (36) public, 59 "semi-public", and 540 rural individual water supplies, representing a cross-section of water supply practice in Kentucky, were selected for study. These systems serve over 50 percent of the State's population.

The principal findings and conclusions of the study are:

WATER SUPPLY STATUS

Water Quality-Bacteriological

Seventeen (17) percent of the public water systems examined did not meet bacteriological standards one or more of the past 12 months. These systems serve approximately 12,500 people. No data existed to determine bacteriological quality of an additional 17 percent of the public water systems.

Seventy (70) percent of the rural individual supplies examined failed to meet bacteriological standards and fecal contamination was confirmed in two-thirds of these cases. These systems serve approximately 1,900 people.

Thirty-six (36) percent of the "semi-public" systems examined failed to meet bacteriological standards. It is estimated that as many as 17,971 people (State residents and the traveling public) may be exposed to this water during one year's time.

Water Quality-Chemical

Ninety-seven (97) percent of the public water systems examined met mandatory chemical drinking water standards.

Ninety-eight (98) percent of the rural individual water supplies examined met mandatory chemical drinking water standards.

All but one of the "semi-public" water systems met the mandatory chemical drinking water standards.

Twenty-two (22) percent of the public water systems examined did not meet one or more of the recommended chemical drinking water standards. These systems serve approximately 69,250 people with less than desirable or aesthetically inferior drinking water.

Forty-one (41) percent of the rural individual water systems failed to meet one or more of the recommended chemical standards. These systems serve approximately 1,100 people.

Thirty-four (34) percent of the "semi-public" systems failed to meet one or more recommended chemical standards. As many as 13,326 people (State residents and the traveling public) may be exposed to this water during one year's time.

Facilities

Fifty-eight (58) percent of the public water systems needed additional treatment facilities and 73 percent needed important changes in the operation of present facilities. Without these additions and changes, continuous production of safe drinking water may not be maintained.

None of the 14 public water supply fluoridation programs evaluated were fully acceptable. Sixty-four (64) percent of these systems were fluoridating at less than the proper level, significantly reducing the dental health benefits of this treatment.

Twenty-eight (28) percent of the public supplies and 68 percent of the 41 "semi-public" supplies examined which chlorinate did not provide a detectable chlorine residual in all parts of the distribution system. Unsatisfactory chlorination practice reduces the margin of safety against disease transmission through drinking water.

Nineteen (19) percent of the public water systems examined had inadequate distribution system storage and 8 percent had inadequate water pressures in some or all areas of the distribution system.

Ninety-two (92) percent of the public supplies examined had inadequate cross-connection control programs. Flawless treatment avails nothing if the distribution system does not deliver adequate water for essential health needs or permits entrance of hazardous substances through cross-connections or other system deficiencies.

Eighty-three (83) percent of the "semi-public" systems rated overall less than "satisfactory" and 56 percent needed additional treatment. Thirty-four (34) percent had visible sanitary defects, which clearly present the potential for dangerous contamination.

Operator Competence

Eighty-one (81) percent of the public water supplies examined were maintaining inadequate operational records and/or conducting inadequate water quality testing.

Thirty-nine (39) percent of the public water systems evaluated had only part-time operators and 56 percent of public water supply operators were not certified by the Kentucky State Department of Health. Most of these systems also had water quality problems and/or facilities deficiencies.

Surveillance

Sixty-four (64) percent of the public water systems studied did not meet bacteriological surveillance standards. Although ninety-four (94) percent of public water systems received a chemical evaluation during the past three years, most evaluations did not include all 26 constituents listed in the Drinking Water Standards. Sixty-seven (67) percent of the public supplies had not been rated by a representative of the Kentucky State Department of Health during the previous twelve months. Without health agency surveillance, hazardous conditions will persist undetected and uncorrected.

Thirty-seven (37) percent of the "semi-public" water systems studied had not had a health agency visit in the previous two years. Even when made, these visits often do not include a full inspection of facilities and operational practices.

WATER SUPPLY PROGRAM

The funds expended for drinking water protection in Kentucky are totally inadequate to support a comprehensive program.

The Division of Sanitary Engineering operates on a budget of only $103,075, with approximately $82,500 available for the administration of the Water Supply Program. Even taking into consideration laboratory support provided by other programs, less than 2.6 cents per capita per year is spent to protect drinking water.

Staff limitations have prevented the Water Supply Program from fulfilling its responsibilities. Evaluation of Kentucky water supply practice indicates many supplies are deficient and present a high risk to the public. Because the Division employs only five sanitary engineers, with approximately four man-years being devoted to the Water Supply Program, important activities are not being performed or are being performed in a superficial manner, seriously reducing the effectiveness of the program. A Water Supply Program conducted in this manner creates a false sense of security.

In spite of increases in the number of water supplies and the population served by these supplies, the staff of the Division of Sanitary Engineering has dwindled from nine in 1963-66 to five at the present time. Ten experienced men have left the program in the past seven years. Unfortunately, the water supply experience of those who left was generally greater than their replacements.

Compliance with Departmental directives has generally been obtained through persuasion and cooperation with County Health officers, who have issued "boil water" orders. However, failure to initiate legal proceedings against the City of Covington, which has ignored a written

Department Compliance Order on fluoridation, has weakened the Department's credibility and compromised its effectiveness. In addition, the penalty for violating the Water Supply Rules and Regulations is insufficient.

Current Public Water Supplies Regulations were adopted July 20, 1967, and provide useful guidance for certain water supply matters. Bacteriological and chemical finished water quality standards are included. A crucial omission, however, is the lack of a specified sampling frequency for either bacteriological or chemical quality. The Regulations do not specifically require disinfection of all public water supplies, although disinfection equipment is discussed in detail. No provision is made for the planned and orderly development of new public water supplies.

The Division of Sanitary Engineering's water supply policies are contained in a number of letters, publications and documents which provide the bases for sound water supply practices. However, the absence of a single water supply policy document has hampered Water Supply Program staff, waterworks officials, and consulting engineers.

Consistent engineering review of bacteriological laboratory results has not been provided by the Division of Sanitary Engineering, and at present no systematic procedure to examine and record bacteriological data is in use. In addition, follow-up and resampling procedures, if pursued at all, are not adequate. A bacteriological surveillance program conducted in this manner negates the conscientious efforts of those collecting and analyzing samples. Such a program creates a false sense of security for water supply operators and the public.

Operator training activities have reached a majority of the public water supply operators. Nevertheless, facility and operational deficiencies indicate that recommended waterworks practices and public health protection are not being universally applied.

An immense quantity of data must be assembled, analyzed, and stored for successful management of a water supply program. This important activity, now being done entirely by "hand", is considered too time consuming for professional personnel, and is seldom given proper attention.

****

In summary, the Kentucky Water Supply Program is not providing the health evaluation and engineering services necessary to fulfill its responsibilities to protect the health of the citizens of Kentucky. To properly provide such services, the following recommendations are made.

RECOMMENDATIONS

It is recommended that:

1. The Water Supply Program be restored to a stature commensurate with its importance to the health of Kentucky residents with a minimum annual budget of $514,000. These funds should be used as follows:

a.	Water Supply Activities	$359,000
b.	Laboratory Services	$155,000
	Total	$514,000

2. The Water Supply Program be initially staffed with a minimum of 18 professionals and 6 secretaries.

3. Water Supply activities be further decentralized by assignment of two additional staff to assist the Sanitary Engineer stationed at the Earlington Regional Office and establishment of two new Regional Offices, one in the southeast and one in the northeast, as soon as competent staff can be recruited and trained.

4. One bacteriologist and one secretary be hired by the Division of Sanitary Engineering and assigned to the Division of Laboratory Services for additional water bacteriology work. Similarly, two chemists and one

secretary should be hired and assigned to the Division of Laboratory Services for drinking water chemical analyses.

5. The Water Supply Regulations be revised and expanded to more comprehensively reflect current recommended water supply practice. Specific features should be included to:
    a. Establish a minimum sampling frequency for acceptable bacteriological surveillance.
    b. Clarify and reword the quality standards for finished drinking water.
    c. Require mandatory disinfection of all water systems serving the public, and specify a minimum distribution system residual for systems disinfecting with chlorine.
    d. Redefine a cross-connection.
    e. Provide for orderly development of new supplies.
    f. Require that water system plans and specifications be prepared by registered professional engineers.
    g. Require that an individual or group be designated legally responsible for each Public Water Supply.

6. Cooperative compliance with Water Supply Rules and Regulations continue to be emphasized. However, if cooperation and persuasion fail to achieve prompt compliance to protect drinking water and public health, enforcement measures as provided by statue should be initiated.

7. A single document be prepared and distributed which presents all current Kentucky Water Supply Program Policy. Provision should be made for updating this document as policy revisions occur.

8. The Division of Sanitary Engineering increase and improve its surveillance of drinking water supplies to at least the minimum levels set forth in the Public Health Service Drinking Water Standards and Manual for Evaluating Public Water Supplies. These activities should include, but not necessarily be limited to:
   a. Thorough periodic sanitary surveys of each system, setting priorities and time schedules for improving those systems with deficiencies.
   b. Bacteriological surveillance sufficient to check laboratory analyses provided by the larger public water supplies, and in the case of small systems without laboratories, bacteriological surveillance sufficient to meet recommended Standards.

c. Complete routine chemical analyses of all drinking water.

9. All water plant laboratories continue to be certified by the Kentucky State Department of Health as to their capability of performing "official" bacteriological analyses.

10. Automatic data processing techniques be employed for storage, analysis, and retrieval of water supply data.

INTRODUCTION

This Evaluation was conducted to determine the effectiveness of the Kentucky Water Supply Program, and if necessary, to recommend such improvements as may be needed to assure safe, wholesome drinking water for the residents of Kentucky.

The study was undertaken by the Water Supply Section, Environmental Protection Agency, at the request of Dr. William P. McElwain, Commissioner, Kentucky State Department of Health, who stated, "A potential health hazard appears to be evident to the people of our commonwealth through lack of adequate surveillance of public water supplies and training of water plant operators".

BACKGROUND

The Kentucky State Board of Health was established in 1878 as a result of a yellow fever epidemic. The Board acted in an advisory capacity on public health matters, including drinking water supply, in these early years. In 1910, a U. S. Public Health Service Sanitary Engineer was assigned to Kentucky and in 1918 the Bureau of Sanitation was formed. Mr. F. C. Dugan joined the Bureau of Sanitation in 1922. He was to guide this activity for 37 years. The number of people served by the public water supplies increased in the ensuing years, and the Water Supply Program gradually increased its staff and activity. Reorganizations placed the Program in various Department of Health bureaus and divisions, leading to its present location in the Division of Sanitary Engineering. However, increased water pollution control emphasis caused a shift of key Water Supply Program staff to the pollution control activity, and since 1966, the Water Supply Program has declined in staff and budget.

PURPOSE OF EVALUATION

Specifically, this Evaluation attempted:

1. To ascertain the present condition of Kentucky's water supplies through inspections of treatment plants and distribution systems; laboratory analyses of drinking water samples for bacteriological chemical, and radiochemical constituents; and, examination of pertinent data recorded in State Department of Health files.

2. To determine the adequacy of legal statutes, budget, manpower resources, regulations and policies, laboratory support, surveillance, and operator training.

3. To review the effectiveness of the Water Supply Program in the light of the present condition of the State's water supplies, and to make recommendations as to what additions and revisions should be made to assure adequate health protection for those drinking water in Kentucky.

SCOPE

WATER SUPPLIES IN KENTUCKY

According to the 1970 census, 3,218,706 people reside in Kentucky. About 2 million of these people are served by 423 public water supplies. Many of the remaining 1.2 million people live in rural areas and obtain their drinking water from individual water systems. In addition to the public supplies, there are an estimated 1,800 water systems generally known as "semi-public" which may serve as many as 2.5 million residents and traveling public annually at restaurants, service stations, recreational facilities, schools, trailer courts, and other establishments.

WATER SUPPLIES STUDIED

In discussion with Mr. Ralph C. Pickard, Deputy Commissioner for Environment, and Mr. Nick G. Johnson, Director, Division of Sanitary Engineering, it was agreed that the study would generally follow the procedures used in the national Community Water Supply Study and the Evaluation of the Tennessee Water Supply Program. The principal objective was to evaluate the total Kentucky Water Supply Program, and, if necessary, recommend improvements to assure safe, wholesome drinking water for the residents of Kentucky.

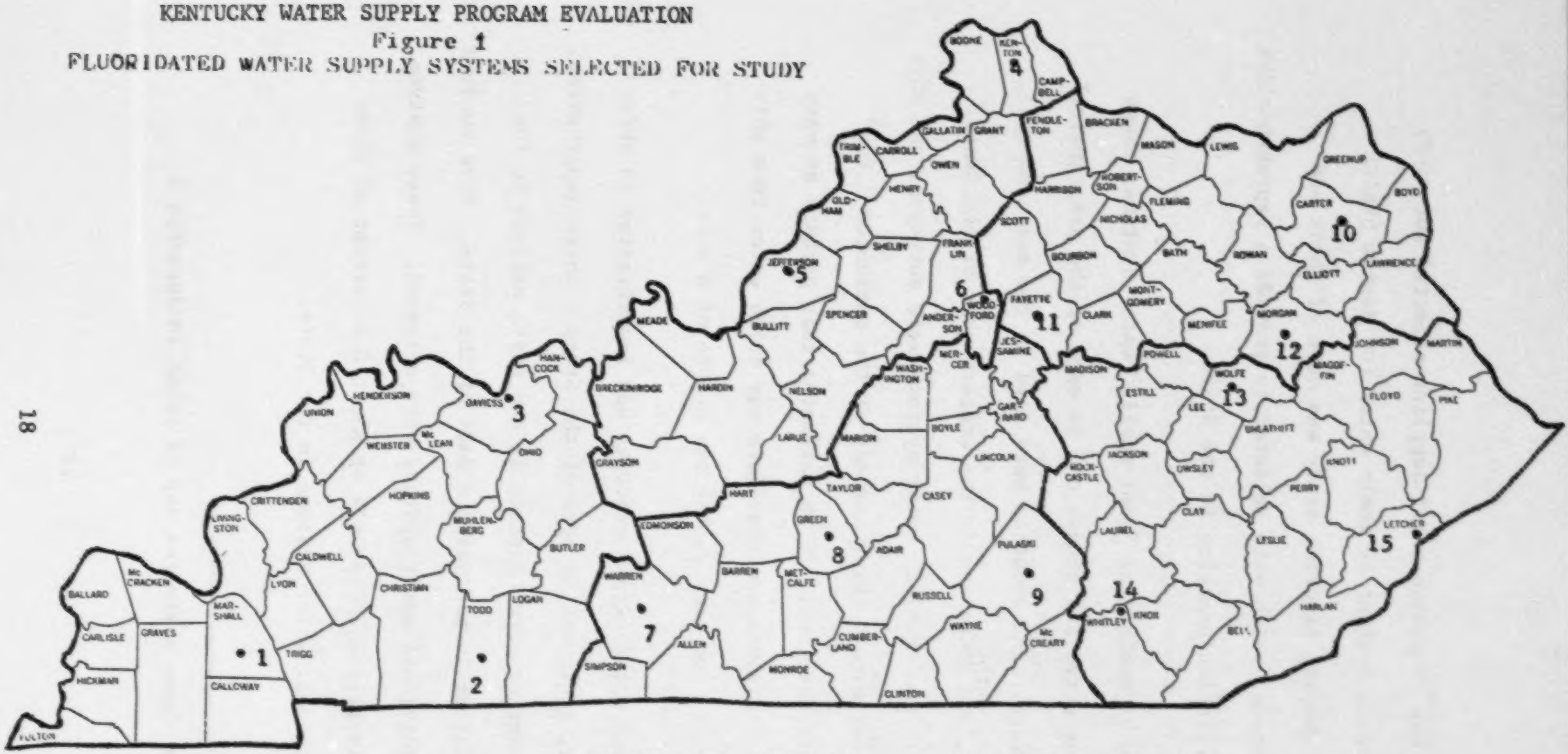
It was agreed that investigation of a representative number of water supplies was sufficient to judge the effectiveness of the Kentucky Water Supply Program. Although statutory authority excludes private individual water systems from the current water supply program, it was decided that each type of supply used by Kentucky residents should be represented in the study. A sample of public, "semi-public", and individual water supplies was selected for study. The technique used for selection of the study sample was not intended to provide a perfect random sample. However, the results are considered to reasonably represent water supply practice in the State.

Twenty (20) public water supplies were selected to reflect sizes, types of source, methods of treatment, and geographical location within the State. In addition, 16 public water supplies from north-central Kentucky that were investigated during the national Community Water Supply Study of 1969, were resurveyed for inclusion in this study. These 36 supplies provide a cross-section of the State's public water supply practice and represent about one-tenth of all public supplies in the State. It is estimated that these 36 systems serve over 1,230,636 people or about 61 percent of all those served by public water supplies in Kentucky. Five (5) of the systems provide drinking water for commercial passenger carriers operating interstate. The number of interstate travelers so served is unknown. A list of the systems surveyed is tabulated in Appendix A and their location is shown in Figure 1.

KENTUCKY WATER SUPPLY PROGRAM EVALUATION

Figure 1

FLUORIDATED WATER SUPPLY SYSTEMS SELECTED FOR STUDY


BOONE
KEN-TON
4
CAMP-BELL
GALLATIN
GRANT
PENDLE-TON
BRACKEN
MASON
LEWIS
GREENUP
BOYD
TRIM-BLE
CARROLL
OWEN
HENRY
OLD-HAM
HARRISON
ROBERT-SON
FLEMING
CARTER
10
SCOTT
NICHOLAS
JEFFERSON
5
SHELBY
FRANK-LIN
BOURBON
BATH
ROWAN
ELLIOTT
LAWRENCE
6
WOOD-FORD
FAYETTE
11
MONT-GOMERY
MEADE
BULLITT
SPENCER
ANDER-SON
CLARK
MENIFEE
MORGAN
12
JOHNSON
MARTIN
HAN-COCK
JES-SAMINE
MAGOF-FIN
HENDERSON
DAVIESS
3
BRECKINRIDGE
HARDIN
NELSON
WASH-INGTON
MER-CER
MADISON
POWELL
WOLFE
13
FLOYD
PIKE
UNION
WEBSTER
Mc LEAN
OHIO
LARUE
MARION
BOYLE
GAR-RARD
ESTILL
LEE
BREATHITT
GRAYSON
LINCOLN
ROCK-CASTLE
JACKSON
OWSLEY
KNOTT
CRITTENDEN
HOPKINS
HART
TAYLOR
CASEY
PERRY
LIVING-STON
MUHLEN-BERG
EDMONSON
GREEN
8
CLAY
CALDWELL
BUTLER
ADAIR
LAUREL
LESLIE
LETCHER
15
BALLARD
Mc CRACKEN
LYON
CHRISTIAN
WARREN
BARREN
MET-CALFE
PULASKI
9
14
MAR-SHALL
TODD
LOGAN
RUSSELL
WHITLEY
KNOX
HARLAN
CARLISLE
GRAVES
1
TRIGG
7
ALLEN
CUMBER-LAND
WAYNE
Mc CREARY
BELL
HICKMAN
CALLOWAY
2
SIMPSON
MONROE
CLINTON
FULTON

North Central District
4-Kenton Co. W.D. #1
5-Louisville
6-Midway

North East District
10-Grayson
11-Lexington
12-West Liberty

West District
1-Benton
2-Elkton
3-Owensboro

South Central District
7-Bowling Green
8-Greensburg
9-Somerset

South East District
13-Campton
14-Corbin
15-Jenkins

Eleven (11) of the 36 public water supplies selected for study adjust the fluoride content of their water for dental health protection. A special fluoride study was made of these and three other systems, which were selected to provide a representative sample of fluoridation practice in the State.

For the purpose of evaluating "semi-public" water systems, three counties were selected for study, one in each of the geographical areas of the State. The counties were Boyd in the east, Russell in the central, and McCracken in the western part of the State. Fifty-nine (59) "semi-public" water systems were surveyed, and this represents approximately three percent of the estimated 1,800[1] supplies in this category. It is estimated that perhaps as many as 2.5 million residents and travelers may drink water from this type of supply at some time during the course of a year.

Rural individual water supply practice was investigated in three other counties, again one in each of the State's three geographical areas. The counties were Lawrence in the east, Madison in the central, and Butler in the western part of the State. Five hundred forty (540) individual water systems were surveyed. These systems served approximately 2,700 people or about 0.2 percent of those served by individual water systems in the State.

---

[1] The bases for these estimates may be found in Appendix B

PROGRAM EVALUATION

The basic water supply Statute, regulations, and program policies were reviewed. The Water Supply Program's activities, responsiveness to water supply problems, and staffing were also examined. Reported waterborne disease outbreaks were studied. Additionally, many residents, waterworks personnel, municipal officials, health officials and others were interviewed.

Four bacteriological laboratories were surveyed and evaluated. These included the Department's Central Laboratory, and three water treatment plants previously certified by the Department of Health. The Department's Water Chemistry Laboratory and the Water Supply Program's chemical surveillance activity were also studied.

EVALUATION CRITERIA

The effecciveness of the Kentucky Water Supply Program was gauged to a large degree on the bases of drinking water quality, adequacy and condition of water system facilities, and water supply surveillance.

WATER QUALITY

Bacteriological quality of public water systems was judged by comparing the previous 12 months bacteriological sampling record against the Public Health Service Drinking Water Standards. Any system failing to meet the bacteriological limits one or more of the past 12 months was considered to have failed the bacteriological standard. Since the Water Supply Program does not routinely sample "semi-public" and rural individual water systems, they were judged on the basis of a single bacteriological sample collected during the field visit and examined by Health Department Laboratories. Any system having total coliforms in concentrations exceeding 4/100 ml and/or having fecal coliform bacteria was considered to have failed the bacteriological standard.

Chemical quality of public water supplies was judged on the basis of water samples collected from the water treatment plant and from two or more locations near the extremities of the distribution system. Carbon filter and pesticide samples were also collected at treatment plants utilizing a surface water supply source. These samples were analyzed by Environmental Protection Agency Laboratories. Each sample was compared individually to the Public Health Service Drinking Water Standards and determined as either:

1. Meeting the Standards for all constituents, or
2. Meeting all "mandatory" constituent limits, but failing to meet one or more "recommended" constituent limits (some are aesthetic parameters), or
3. Failing to meet one or more "mandatory" constituent limits.

The chemical quality of "semi-public" and rural individual water systems was judged on the basis of chemical samples collected at the time of the field visit and analyzed by Environmental Protection Agency Laboratories.

FACILITIES

Public water supply source, treatment, operation and quality control were judged on the bases of the Manual for Evaluating Public Drinking Water Supplies and the Drinking Water Standards, employing the same interpretation as were used in the Community Water Supply Study for uniformity.

Source

Quality of the source was judged where possible by chemical analyses, and also by past experience of the treatment plant operator. Quantity was judged by historical experience and current water demands. Source protection was judged by the type of source, and potential and/or actual problems.

Treatment

Treatment was judged on the bases of the facilities and their operation (as observed on the day of the field visit), bacteriological records and chemical analyses. Effectiveness of disinfection was judged by the presence of a detectable free chlorine residual in all parts of the distribution system.

Distribution System

Finished water storage was judged adequate if elevated or non-pumped storage equaled or exceeded the system's average daily demand. Pumped storage was included only where on-site internal combustion or steam auxiliary powered pumping equipment was available. Raw water storage was also included if auxiliary power was available to provide treatment and pumping. Storage for "distribution only" systems included consideration of storage in the parent system. A distribution system pressure of at least 20 psi in all parts of the system was considered adequate for the purpose of this study. However, a minimum of 25 psi is considered desirable to insure optimum operation of all plumbing fixtures.

Quality Control

Water quality testing was judged by the bacteriological and chemical tests being performed by the water purveyor on finished water. Record keeping practices were judged by records maintained at the water treatment plant or water treatment plant operator's office and available for inspection at the time of the field visit. The cross-connection control program was judged by the existence of an ordinance, program implementation, and progress toward eliminating hazards.

As shown in Table III, Appendix A, water system facilities were divided into ten categories for examination and rating. Each system was then assigned a Risk Factor ranging from 0 to 10, which reflects the number of facility deficiencies found. Zero facility deficiencies ("0" Risk Factor) indicates least or little risk. Ten facility deficiencies ("10" Risk Factor) indicates most or high risk.

"Semi-public" and rural individual water systems were judged on the basis of the Manual of Individual Water Supply Systems in addition to the reference already cited. The adequacy of these facilities was judged on the basis of a sanitary survey accomplished at the time of the field visit.

SURVEILLANCE

Water supply surveillance was judged on the bases of the Drinking Water Standards and the Manual for Evaluating Public Drinking Water Supplies. Bacteriological surveillance was considered satisfactory if the number of bacteriological samples examined per month during the preceding 12-month period met the minimum number specified by the Drinking Water Standards. Chemical surveillance was considered satisfactory if chemical constituents (as distinguished from normal in-plant operational checks) were examined within the past three years and there was no record of significant problems. Engineering surveillance was considered satisfactory if a rating by Division of Sanitary Engineering personnel had been made sometime during the preceding 12 months. More frequent inspection, however, is considered necessary for optimum surveillance.

OTHER CRITERIA

Bacteriological laboratories were judged on the basis of the Public Health Service Manual entitled, Evaluation of Water Laboratories, and Standard Methods for the Examination of Water and Wastewater. Chemical laboratory procedure was also judged by Standard Methods.

The adequacy of operator training was judged by the absence or presence of operational and quality control deficiencies, the operator's certification status, and the operator's awareness of the relationship between drinking water quality and public health.

FINDINGS

WATER SUPPLY STATUS

Water Quality

The bacteriological quality of Kentucky water supplies is reflected by the following:

> Seventeen (17) percent of the public water systems examined did not meet bacteriological standards one or more of the past 12 months. These systems serve approximately 12,500 people. No data existed to determine bacteriological quality of an additional 17 percent of the public water systems.
>
> Seventy (70) percent of the rural individual supplies examined failed to meet the bacteriological standards and fecal contamination was confirmed in approximately two-thirds of these cases. These systems serve approximately 1,900 people.
>
> Thirty-six (36) percent of the "semi-public" systems examined failed to meet the bacteriological standards and fecal contamination was confirmed in five percent of these cases.

> It is estimated that as many as 17,971 people (State residents and the traveling public) may be exposed to this water during one year's time.

Failure to meet bacteriological standards indicates a serious, potential health hazard and calls for prompt corrective action. Additional details and supporting data may be found in Appendices A, B, and C.

Chemical analyses of the water systems studied indicated that:

> Ninety-seven (97) percent of the public water systems examined met the mandatory chemical standards.
>
> Ninety-eight (98) percent of the rural individual water supplies examined met mandatory chemical drinking water standards.
>
> All but one of the "semi-public" water systems met the mandatory chemical drinking water standards.

Drinking water must not contain any impurities which may be toxic or otherwise hazardous to human health. Drinking water failing to meet the mandatory chemical standards poses such a threat.

> Twenty-two (22) percent of the public water systems examined failed to meet one or more

of the recommended chemical standards. These systems serve over 69,250 people.

Forty-one (41) percent of the rural individual water supplies examined failed to meet one or more recommended chemical standards. Approximately 1,110 people are served by these systems.

Thirty-four (34) percent of the "semi-public" water supplies examined failed to meet one or more recommended chemical standards. As many as 13,326 people may be exposed to this water during one year's time.

The recommended chemical standards are intended to assure that no constituent is present in quantities which impart objectionable taste, odor, and/or undesirable physiological effects to drinking water, rendering it less than desirable or aesthetically inferior. Good quality drinking water should contain no impurity which would cause offense to the sense of sight, taste or smell, and should have chemical characteristics considerably better than the limiting values established by the recommended standards. As indicated above, a percentage of the Kentucky supplies in each category studied failed to meet these standards. See Appendices A, B, and C for additional details on chemical quality.

Facilities

Public Water Supplies

A sanitary survey of the water system facilities of the 36 public water supplies studied revealed that:

(Sources)

Twenty-eight (28) percent had inadequate source protection.

Six (6) percent of the sources were of insufficient quantity.

Eleven (11) percent of the sources had unsatisfactory raw water quality.

(Treatment)

Fifty-eight (58) percent of the systems needed additional treatment facilities.

Seventy-three (73) percent of the systems needed important changes in operation of present treatment facilities.

Twenty-eight (28) percent of those systems which chlorinate failed to maintain chlorine residual in all parts of the system.

(Distribution)

Nineteen (19) percent of the systems had inadequate distribution storage.

Eight (8) percent had inadequate water pressures in some or all areas of the distribution system.

(Quality Control)

Eighty-one (81) percent of the systems were not maintaining adequate operational records and/or conducting adequate water quality testing.

Ninety-two (92) percent of the systems were found to have inadequate cross-connection control programs.

Only one of the public water supply systems was found to meet the facilities evaluation criteria. The facilities of the remaining 35 public water supplies were found to be deficient in one or more categories. One system had deficiencies in all ten categories; many had five or more. The average Risk Factor was 4.0 indicating a great potential hazard to public health. See Appendix A for additional details concerning public water systems.

Semi-Public Water Supplies

A sanitary survey of the 59 "semi-public"water supply facilities revealed that:

Fifty-six (56) percent of the systems needed additional treatment.

Sixty-eight (68) percent of the 41 systems which chlorinate were found to have no chlorine residual in the system.

Thirty-four (34) percent were observed to have a visible sanitary defect.

Eighty-three (83) percent received an overall rating less than "satisfactory."

"Semi-public" water systems serve a large number of people in Kentucky and the deficiencies enumerated above indicate a grave potential public health hazard. See Appendix B for additional details concerning "semi-public" systems.

Rural Individual Water Supplies

A sanitary survey of 540 rural individual water systems indicated that:

Twenty (20) percent had sources of insufficient quantity.

Nearly every system had one or more facility deficiencies.

Very few systems were constructed to prevent entrance of contamination.

Ninety-one (91) percent had never been tested for bacteriological quality.

These findings are supported by the fact that 47 percent of the rural individual systems were found to have fecal contamination. This poses a serious public health problem for the rural residents of Kentucky. Additional details may be found in Appendix C.

Fluoride Practice

One hundred nine (109) public water supplies in Kentucky adjust the fluoride content of their water. These supplies serve 1,560,000 of the approximately 2 million people served by public water systems. Approximately 78 percent of all those served by public water supplies in Kentucky receive fluoridated drinking water.

A study of 14 of the public water systems fluoridating revealed that:

> Not one system had a fully acceptable fluoridation program.
>
> Sixty-four (64) percent of the systems were not fluoridating at the proper level.
>
> Fifty-seven (57) percent were deficient in analytical control of fluoridation.
>
> Fifty (50) percent were deficient in fluoridation equipment and facilities.
>
> Fifty (50) percent were deficient in storage and handling of fluoride chemicals.

Twenty-seven (27) percent of the operators were unfamiliar with analytical testing equipment and procedures.

Forty (40) percent of the operators did not accept or were otherwise not interested in fluoridation.

Operator Competence

Evaluation of the operators and their qualifications for the 36 public water supplies studied indicated that:

Thirty-nine (39) percent of the water systems do not have full-time operators. Four of these systems did not have a designated operator.

Fifty-six (56) percent of the operators (nine from systems both treating and distributing water and 11 from systems distributing finished water purchased wholesale) were not certified by the Kentucky State Department of Health.

Fourteen (14) percent of the operators had college level training. Forty-two (42) percent had received their waterworks training at State sponsored short schools. Thirty-one (31) percent of the operators had no formal waterworks training.

All systems with an operator having no formal waterworks training failed to meet water quality standards and/or had a Risk Factor of 3 or greater.

All systems with a non-certified operator failed to meet water quality standards and/or had a Risk Factor of 3 or greater.

Eighty-seven (87) percent of the systems with a short school trained operator failed to meet water quality standards and/or had a Risk Factor of 3 or greater.

The operation of "semi-public" water systems varies widely with type and size of the establishment served. Often the owner, manager or person-in-charge also acts as water treatment operator. In some cases operation of the water facilities is delegated to maintenance personnel. Few, if any, of the "semi-public" water supply operators have received formal waterworks training.

Operation of rural individual water supplies rests primarily with the homeowner or person(s) on the premises.

Surveillance

Of the 36 public water supply systems studied:

Sixty-four (64) percent failed to meet bacteriological surveillance standards.

Ninety-four (94) percent had received a chemical evaluation during the past three years. However, the chemical analyses in most cases did not include all 26 constituents listed in the Drinking Water Standards.

Sixty-seven (67) percent of the systems had not been rated by a representative of the Kentucky Department of Health during the previous 12-month period.

Review of the 59 "semi-public" water systems indicated that:

Thirty-seven (37) percent had not had a health agency visit in the previous two years. In most cases, a visit consisted of collecting a water sample and did not include a full inspection of facilities and operational practices.

In general, routine surveillance of "semi-public" systems was provided by county sanitarians who are not fully trained in maintenance and operation of water treatment facilities.

Bacteriological and chemical surveillance were considered inadequate for systems serving the public.

Because water program statutory authority specifically excludes private water supplies, there is no routine surveillance of rural individual water systems in Kentucky. Only those problems or complaints brought to the attention of State and local health officials are investigated. This places a heavy burden on the layman who obtains his drinking water from a rural individual supply for it is he who must decide that a water supply problem exists and then seek assistance.

WATER SUPPLY PROGRAM

Authority

The Kentucky State Department of Health (hereinafter designated Department) administers the State Water Supply Program pursuant to the authority of Kentucky Revised Statute (KRS) 211.090 (1) (d) and KRS 211.180. KRS 211.180 states:

> "The department shall enforce rules and regulations adopted by the board for the regulation and control of the matters set out below...: ... the purification of water for public and semi-public use; the proper construction and operation of public water purification plants and distribution systems, ... including the issuance of permits to and the supervision of operators thereof; ... the review, approval or disapproval of plans for construction, modification, or extension of ... water purification and distribution systems ...".

Additional statutory authority is provided by KRS Chapter 223, which provides that every operator in responsible charge of a water treatment plant hold a certificate of competency issued by the Commissioner of Health.

Water Supply Regulations are developed by the Department's Division of Sanitary Engineering and adopted by the Board and are enforceable as provided under KRS 211.990 and KRS 223.990. The current "Kentucky Public Water Supplies and Fluoridation Regulations" were adopted in 1967 by the State Board of Health. "Water Treatment Plant, Water Distribution System, and Sewage Treatment Plant Operators," which provides for operator certification, was also adopted in 1967.

In addition to the Statute and Regulations, the Division of Sanitary Engineering establishes policies and procedures for the administration of the Water Supply Program.

Statute

The Kentucky Revised Statute provides the Division of Sanitary Engineering with broad, general authority to conduct a program to supervise design, construction and operation of public water supplies. Details, such as definitions of the terms "public water supply," and "semi-public water supply," are not provided. No authority is granted to regulate private water supplies, except such as could be assumed under KRS 211.210, "Abatement of nuisances."

KRS 211.990 (2) provides that anyone violating rules and regulations adopted by the Board or failing to comply with an order issued pursuant thereto shall be fined not less than $10.00 nor more than $100.00. Each day of such violation or non-compliance constitutes a separate offense.

Regulations

The regulations for public water supplies currently in use by the Division of Sanitary Engineering were adopted July 20, 1967, and became effective August 31, 1967. These regulations entirely superseded an earlier document. Most recent regulations pertaining to fluoridation of public water supplies were adopted separately by the Board, and became effective March 3, 1963. Regulations pertaining to certification of operators of water treatment plants and water distribution systems were adopted and became effective August 31, 1967.

The public water supply regulations provide definitions of key terms in Section (2), including "Public Water Supply," which "means any water supply serving the public irrespective of its ownership or operation and made available for drinking and/or domestic use," and "Private Water Supply," which "means a residential water supply located on private property under the control of the homeowner, the use of which is limited to members of his family."

Section (3) requires that all public water supplies in the State comply with the rules and regulations. Section (4) requires submission of plans and specifications to the Department. Section (5) authorizes the Department to conduct inspections. Section (6) requires submission of operation reports to the Department. Sections (7), (8), and (9) relate to disinfection of water and new or repaired portions of the distribution system, and disinfection equipment. Section (10) prohibits all cross-connections. Section (11) specifies proper sewer and waste connections. Sections (12) and (13) prescribe detailed standards for bacteriological, physical and chemical quality of finished water.

The fluoridation regulations require that water supplies serving cities of the 1st, 2nd, 3rd, or 4th class adjust the fluoride content to optimum levels for protection of dental health. This provision became effective July 22, 1966, and requires fluoridation for systems serving 3,000 or more persons. The regulations also prescribe equipment requirements and notice be given the Department of discontinuance of fluoridation.

Operator certification regulations require that all water treatment plants and/or water distribution systems be classified in accordance with their size and complexity. Water supply system operators are certified on the basis of their education, experience and knowledge. Every operator in responsible charge must hold a valid certificate equal to or higher than the particular water treatment plant or distribution system operated.

Policy

The Division of Sanitary Engineering's water supply policy has developed as a consequence of various situations which occurred over the years. Most policy statements are contained in general memorandums and letters from the Division to specific water supplies. Policy statements have not been assembled into a single document.

Resources

Organization

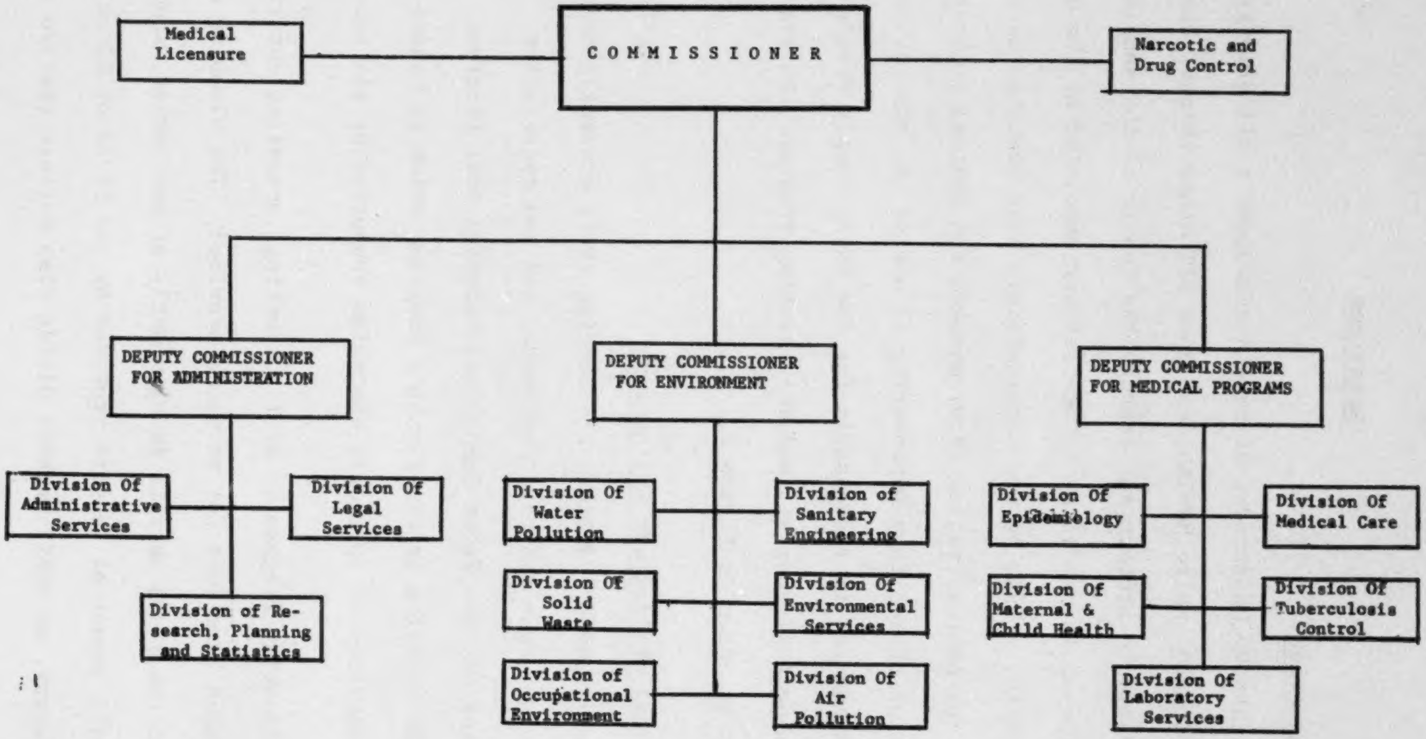
The Kentucky Department of Health administers all provisions of law relating to public health, and does all other things reasonably necessary to protect and improve the health of the people. The Department is headed by a Commissioner appointed by the State Board of Health. Three Deputy Commissioners head branches of the Department for Administration, Environment, and Medical Programs. The Division of Sanitary Engineering is one of the six environmental divisions and is responsible for the Water Supply Program, the Swimming Pool Program, and the Plumbing Program. An organization chart is shown in Figure 2.

Division of Sanitary Engineering

The Division of Sanitary Engineering staff presently consists of a Director, four sanitary engineers, and two secretaries. This staff carries out the Water Supply and Swimming Pool Programs. Also included in the Division is the Plumbing Program, which is headed by a Director and consists of 50 people statewide supported by six secretaries.

The Plumbing Program is self-supporting, operating entirely on funds obtained from fees for services provided. The Plumbing and Water Supply Programs operate independently of each other, and except for a small amount of support provided by the Division Director and his secretary, no staff members divide time between the two programs.

FIGURE 2
KENTUCKY STATE DEPARTMENT OF HEALTH


Medical Licensure
COMMISSIONER
Narcotic and Drug Control
DEPUTY COMMISSIONER FOR ADMINISTRATION
DEPUTY COMMISSIONER FOR ENVIRONMENT
DEPUTY COMMISSIONER FOR MEDICAL PROGRAMS
Division Of Administrative Services
Division Of Legal Services
Division of Research, Planning and Statistics
Division Of Water Pollution
Division of Sanitary Engineering
Division Of Solid Waste
Division Of Environmental Services
Division of Occupational Environment
Division Of Air Pollution
Division Of Epidemiology
Division Of Medical Care
Division Of Maternal & Child Health
Division Of Tuberculosis Control
Division Of Laboratory Services

It is estimated that the sanitary engineering staff of the Division devotes approximately 80 percent of its efforts to water supply program activity, with the remaining 20 percent being devoted to swimming pool work. Based on this estimate, the Water Supply Program is currently being administered by four sanitary engineers and about 1 1/2 secretaries.

The headquarters of the Division is located in Frankfort, and all Water Supply Program personnel except one sanitary engineer operate from this office. All portions of the State are covered out of the headquarters location with the exception of the western district, which is covered by a single sanitary engineer located in Earlington. An organization chart prepared by the Division indicated six districts are conceived for eventual assignment of a sanitary engineer.

Table I presents a summary of the qualifications of the water supply program professional staff. It can be seen that two of the five hold Masters Degrees, and three hold Professional Engineers Licenses.

Current professional salaries are also shown in Table I. It is noted[1] that Kentucky ranks twenty-seventh among States in salary paid to the Director of Public Health Engineering, and thirty-ninth in salary paid to beginning public health engineers.

The Division of Sanitary Engineering's budget for fiscal year 1971 was $103,075. This amounts to approximately nine (9) percent of

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[1] Salary Ranges of Selected State Classes, U. S. Civil Service Commission, July 1, 1971.

TABLE I

SANITARY ENGINEERING PROFESSIONAL STAFF QUALIFICATIONS

ENGINEER	CATEGORY	ANNUAL SALARY	BACHELORS DEGREE	MASTERS DEGREE	PROF. REGIS.	JOINED HEALTH DEPT.	PREVIOUS EXPERIENCE
ohnson, Nick G.	Health Div.Dir.	$17,700	Univ. of Louisville 1943	Univ. of Michigan 1950	Ky.	1947	U.S.Corps of Engrs. - Louisville District
Sites, Clarence H.	Sr. San. Engr.	16,056	Univ. of Scranton 1934	-	Ky.	1957	Henderson Co. Health Dept. Evansville(Ind) City-Co. Health Dept. U.S.Corps of Engrs. - Louisville District
Wilmoth, T. Mike	Sr. San. Engr.	11,976	Tenn.Tech Univ. 1967	Univ. of Kentucky 1970	Ky.	1967	Tenn.St. Highway Dept. (summer Engineer's Aide)
Heilman, Jr., A. J.	San. Engr. Assoc.	11,412	Univ. of Cincinnati 1934	-		1969	Schenley Distillers Frank Fehr Brewing Co. City of Louisville Health Dept.
Seibert, Fred J.	San. Engr. Assoc.	10,344	Univ. of Cincinnati 1939			1970	Philip Carey Co. Volney Felt Mills

the total Environmental Health budget. The Division's 1971 budget was decreased approximately $31,000 from the 1970 budget, and is about $14,000 less than the 10-year average from 1961-1970. This decrease represents a very significant cut-back when viewed in combination with raises in salaries and other business costs during the same period. The number of public supplies requiring surveillance also increased from 324 in 1961 to 423 in 1970, and the population served by these supplies increased approximately 500,000.

Assuming 80 percent of Division of Sanitary Engineering resources is devoted to the Water Supply Program, it is estimated that approximately $82,500 was expended in FY 1971 at the State level for Engineering support and surveillance of public drinking water supplies. This amounts to about $94.50 for each of the 423 public water systems in Kentucky and about $23.50 for each semi-public water system (based on the premise that a semi-public supply should receive about one-fourth the effort spent on a public supply).

Other Assistance

The Division of Laboratory Services, under the Commissioner for Medical Services, provides bacteriological and chemical laboratory support for the Water Supply Program. These laboratories are located in Frankfort, and a branch laboratory in Paducah does bacteriological work. The Division of Laboratory Services also assists by evaluating and certifying the acceptability of procedures used by other water bacteriology laboratories which service public water supplies.

County Health Departments may provide assistance to the Division of Sanitary Engineering by referring problems to the Frankfort office, or by rendering technical assistance at the local level, especially to semi-public and rural individual supplies.

Activities

Engineering

The engineering activities of the Kentucky Water Supply Program are conducted by the Division of Sanitary Engineering. Regulations prescribe that the following engineering services will be provided:

1. Routine engineering field inspection of facilities and operation of all public water supplies, including cross-connection control.
2. Review and approval of plans and specifications for all new construction and modification of existing systems, with technical consultation to consulting engineers, and others.
3. Training and certification of water plant operators.
4. Promotion and supervision of fluoridation.
5. Review of bacteriological and chemical analyses of major public water supplies.
6. Review of monthly operating reports from major public water systems.
7. Technical consultation on special problems and during emergency conditions.

Advisory services to local health departments and other services are also provided:

1. Technical assistance to local health departments for small public water systems (semi-public) and individual water systems.
2. Assistance to other State agencies by providing engineering surveillance of State-owned water supplies.
3. Periodic engineering inspection of facilities and operation of all bottled water supplies in Kentucky.

To meet these responsibilities, the Water Supply Program has adopted a goal that engineering inspection of all public water supplies should be made four times per year. However, staff limitations have never allowed this goal to be attained. In 1970, the average number of engineering inspections per water system was 0.9, down from an average of 1.1 in 1969. Of 423 existing systems, 82 were rated "approved;" 196 were rated "provisional;" 26 were rated "unapproved;" and 119 were not rated at all.[2] To improve frequency of surveillance, program officials have initiated a system combining telephone contact and on-site inspections. The goal is to make three telephone contacts and one routine on-site inspection per supply per year with a complete on-site inspection each four years.

Essential to the engineering inspection activity is the "rating" system. Following a field inspection, the water system is assigned a rating of "approved," "provisional," or "unapproved" to reflect the condition of physical equipment, the type of operation and maintenance, and the quality of water delivered. A copy of the rating forms is included in Appendix E. A short form is used for an annual routine inspection and a longer form is used for a complete inspection once every four years. Only those systems without major deficiencies receive an "approved" classification.

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[2] Status of Public Water Supplies in Kentucky, Division of Sanitary Engineering, Kentucky State Department of Health, October 1970.

The field evaluation of 36 water systems revealed significant findings regarding the engineering inspection and rating program. The Kentucky Water Supply Program had inspected 33 percent of these 36 water systems during the past year. However, Environmental Protection Agency field evaluations indicated that only 17 percent of the 36 systems had a Risk Rating of less than three (3). A comparison of the Risk Rating and the State's rating is presented in Table V, Appendix A. Of the fourteen (14) water systems that were rated "approved" by the State, nine (9) were found to have a relative Risk Rating of 3 or greater indicating that the ability of these water systems to continually deliver safe drinking water is suspect.

The review of 700 plans and specifications by the Water Supply Program required approximately 2 1/2 man-years of professional time in 1969. The review activity is required by law and involves detailed calculations. A concentrated effort has been made to carry out this activity, often at the sacrifice of other important activities. However, a related activity, for supervision and inspection of the resultant construction projects, is not performed by the Water Supply Program.

The Water Supply Program conducts an annual four-day short school, assists in regional short schools as time allows, and provides on-site training during water system engineering inspections. It is estimated that 85 man-days per year are devoted to the administration and training involved with the State's mandatory water system operator certification law. At the present time, there are 552 water plant operators certified under this program, and they operate 50 percent of the 423 public water supplies in Kentucky. Of the 36 public water systems surveyed in this study, 44 percent had certified operators and 42 percent of the operators had received State short school training.

The Water Supply Program estimated in 1969 that approximately 2 professional man-years of effort were required to adequately review and evaluate monthly operating and water quality data reports. Current manpower reductions have severely limited these important activities.

Advisory service to local health departments and other State agencies has not been a priority activity. The Water Supply Program has prepared a partial inventory of small or "semi-public" water supplies and has provided some infrequent service to these supplies, primarily in the area of plan review. However, a program has been conceived to improve this surveillance. The State program will supply county sanitarians with a short inspection form and will request quarterly sanita[illegible] surveys of these systems. The State will maintain a central file o[illegible]i-public" water systems and provide technical assistance, if necessary. This program has been initiated several times in past years but never fully implemented.

The Water Supply Program has issued a policy document entitled "Bottled Water Requirements" to regulate bottled water producers doing business in the State. Two Kentucky bottled water companies with combined annual sales of approximately 660,000 gallons are operating with Water Supply Program approval. Two out-of-State bottled water producers have also been authorized to distribute bottled water in Kentucky.

Laboratory

Laboratory surveillance of drinking water quality in Kentucky is divided among many individuals and agencies. Sample collection may be done by Division of Sanitary Engineering personnel, county sanitarians or water plan operators. Analyses may be performed by the Division of Laboratories, private laboratories, or the water purveyor. Only 36 percent of the public water supplies surveyed in this evaluation met the bacteriological sampling frequency recommended by the Drinking Water Standards during the past twelve months. Ninety-four (94) percent had received a chemical analysis of the water within the past three years. However, this analysis did not include all constituents listed in the Drinking Water Standards.

(Bacteriological)

The bacteriological laboratory services of the Department of Health are provided by the Division of Laboratories. The Division of Laboratories operates a central laboratory in Frankfort and a branch laboratory in Paducah. This geographical spread enables sample travel time to be maintained within the 30-hour limit prescribed in Standard Methods. Current Water Supply Program sampling policy requires that each public water supply submit only two (2) distribution system samples per month to a State laboratory. In addition, all public water supplies are encouraged to sample at the frequency recommended by the Public Health Service, Drinking Water Standards. The state recommends that large water systems maintain their own bacteriological laboratories. Consequently, there are fifteen (15) water systems performing bacteriological analyses and six (6) city-county health departments which have bacteriological laboratories certified by the Division of Laboratories.

Bacteriological samples collected by State, county or water works personnel from water distribution systems and submitted to the State laboratories are considered "official" while samples analyzed at water plant laboratories are not considered "official" unless the laboratory has been certified by the State. The information reported in Table IV, Appendix A indicates that the number of "official" samples examined for 23 of 36 water supplies was insufficient to meet the requirements of the PHS Drinking Water Standards.

As part of the study of the Kentucky Water Supply Program, the Central State Laboratory and three water plant laboratories were evaluated (see Appendix F). Each of these water plant laboratories had been previously certified by the State. The Central State Laboratory was found to be in substantial compliance with accepted procedures for bacteriological examinations as was one of the water plant laboratories. However, significant deviations from accepted procedures were found in the other two laboratories. One was found to be in such non-compliance that it was recommended that all previous data from the laboratory be marked "void" and stricken from the record.

The PHS Drinking Water Standards define an unsatisfactory bacteriological sample for each recognized sample examination technique. For example, an unsatisfactory sample by the membrane filter technique is one which has in excess of 4 coliform colonies per 100 ml. The Standards also require that if an unsatisfactory sample is observed, daily samples from the same sampling point shall be collected promptly and examined until results obtained from at least two consecutive samples show the water to be of satisfactory quality. Kentucky Water Supply Rules and Regulations provide similar definitions and require a similar response. However, a bacteriological response practice has evolved which is different from either the Standards or State Regulations. This practice is in a sense more restrictive because it requires three follow-up samples when samples examined by the membrane filter technique exceed one coliform colony per 100 ml. However, the requirement to continue daily resampling from the same point until at least two consecutive satisfactory samples have been examined has been dropped. Practices which are in conflict with or differ from published Rules and Regulations create confusion and misunderstandings. This and other bacteriological surveillance practices not strictly in accord with the Drinking Water Standards are summarized below:

a. The lack of resampling from the same location on successive days until two negative results are secured. The state policy of three follow-up samples may be met with three samples collected on the same day.

b. The slow processing of positive (unsatisfactory) results by the Central Laboratory reporting section.

c. A lack of understanding by some sample collectors as to what constitutes the proper response to positive (unsatisfactory) laboratory results.

d. The lack of an effective data handling procedure by the engineering activity. As a result, bacteriological data is not being fully utilized to monitor drinking water quality.

e. The need for a revised bacteriological sample identification form. The present form does not indicate the exact point of collection. Several systems visited during the survey were found to be collecting all their bacteriological samples at the plant.

The problem at the Central Laboratory is apparently related to lack of staff and resources for record keeping and reporting. This data handling delay (both in the laboratory and the engineering section) has, in part, defeated efforts to provide a responsive surveillance program.

(Chemical)

The water chemistry laboratory of the Kentucky State Department of Health is operated by the Division of Laboratory Services at the Central Office in Frankfort. In 1970, 420 analyses were made for chemical quality. The basic chemical analyses are run by this section along with some support from other laboratory sections (Water Pollution, Air Pollution, Occupational Health, and Radiological Health). These additional services are provided on a request basis and are subject to the priorities of the other programs.

During the field surveillance activities of this study, it was noted that 94 percent of the 36 water systems had had a chemical analysis performed on their water during the past three years. However, the majority of these analyses were not complete chemical analyses. Only nine (9) systems have ever had a complete chemical analysis; all of which are or were involved in the Federal-State Interstate Carrier Program.

As a part of this program evaluation, a special evaluation of the Division of Laboratory Services Chemistry Section was conducted. Analyses performed, methods, equipment, staffing, and space requirements were examined. Routine chemical analysis of drinking water, as currently practiced by the laboratory, includes acidity, alkalinity, hardness, iron, manganese, magnesium, nitrate, chloride, sulfates, fluoride, pH, calcium, TDS, color, odor, and turbidity. This constitutes adequate surveillance for operational purposes, but only a partial chemical analysis of drinking water as compared with the extent of analyses called for in the PHS Drinking Water Standards. Trace metals, organics and pesticides are not currently being run for public water supplies, although the laboratory is equipped to run most of these constituents.

The following deficiencies were noted in the State Chemistry Laboratory drinking water quality monitoring:

(1) Only 10 out of 26 substances specified in the Drinking Water Standards are being run routinely.

(2) Non-standard methods are being used for the determination of color, nitrates, sulfates, and turbidity.

(3) The laboratory does not have an internal quality control program.

(4) The present staff is inadequate to handle the required additional trace metals analyses and radiochemistries.

(5) The Water Supply Program has an excellent chemical data filing system, but it is not up to date and the overall status of water supply chemical monitoring is difficult to determine.

(6) The fluoride content of each water supply serving over 3,000 people is supposed to be checked twice a month, but State records are inadequate to substantiate compliance with this policy.

(7) No distribution system sampling for chemical quality is being done.

Chemical laboratory capability was found at 12 of the 36 water systems surveyed. In general the water purveyors are not required to perform anything more than a partial chemical analysis, primarily to monitor water treatment operations. These analyses include alkalinity, CO_2, turbidity, chlorine residual, hardness, fluoride and pH. Of the 12 water systems with chemical laboratories, only five had more than this capability, and none had the ability to analyze the full range of constituents listed in the Drinking Water Standards. One system had acquired a complete analysis by a commercial laboratory. Also, a large water system which treats water drawn from the Ohio River downstream from industrialized areas is trying to develop the capability to analyze for trace metals and exotic materials.

In addition to the lack of complete chemical laboratory capability among the water systems surveyed, eleven systems were found to have a chemical laboratory capability that is not sufficient to maintain adequate water treatment operational control. Nine of these systems utilize surface water requiring complete conventional treatment.

Analysis for radiochemical constituents has never been routinely performed for drinking water supplies in Kentucky. The Kentucky State Department of Health has the competency and the equipment to perform these analyses in their Radiological Health Program. In 1970 148 water samples were examined for the Water Supply Program, but none were examined in 1971 because of other priorities set by the Radiological Health Program.

DISCUSSION

PUBLIC HEALTH RISK

Water Supply Deficiencies

Public health protection of drinking water supplies should assure that each component of the production, storage and distribution process function without risk or failure. Flawless treatment avails nothing if the distribution system permits entrance of contamination through faulty facilities or cross-connections. Similarly, excellent operation of conventional water treatment and distribution facilities will not protect public health if impurities are present in the raw water source which are not amenable to treatment.

Documented incidents throughout the nation have shown that disease outbreaks resulted when contamination of water and inadequate chlorination practices occurred at the same time. As presented in the findings, not all Kentucky public and "semi-public" systems provide adequate chlorination. It was found that twenty-eight (28) percent of the public and 68 percent of the 41 "semi-public" systems which have chlorination facilities were not maintaining chlorine residual in all parts of the distribution system. In addition, 17 percent of the public supplies, 36 percent of the 59 "semi-public" supplies, and 70 percent of the rural individual supplies were found to show evidence of bacteriological contamination. These conditions present serious public health risks.

More toxic industrial and agricultural chemicals are finding their way into our natural waters than ever before. Conventional water treatment processes do not always remove these chemicals. Assurance that these substances are not present in drinking water can only be given by (a) adequate protection of raw water sources, and (b) a surveillance program providing routine complete chemical analyses. It was found that all but two of the public supplies surveyed received a chemical analysis during the previous three years. However, chemical surveillance presently performed does not include analysis for many constituents included in the Drinking Water Standards and others of known health significance. Twenty-eight (28) percent of the public supplies surveyed failed to provide adequate protection for their raw water source, indicating contamination by potentially dangerous substances may be occurring undetected by water supply officials.

From the foregoing it can be concluded that Kentucky drinking water supplies are vulnerable to enteric disease transmission and are not providing sufficient protection against other hazardous impurities.

Waterborne Diseases

Waterborne disease epidemics involving semi-public and rural water systems are documented to have occurred in Kentucky in recent years. In addition, epidemiological records indicate that potentially waterborne diseases occur each year. (See Appendix G). While Kentucky has approximately 1.6 percent of the nation's population, about 3.1 percent of the reported infectious hepatitis, 2.3 percent of the reported salmonellosis, and 2.7 percent of the reported typhoid occurred in Kentucky. A portion of these cases, plus an unknown number of unreported cases, may have been waterborne. In addition, body wastes from these diseased persons pose the constant threat of contaminating drinking water supplies.

In essentially all documented waterborne epidemics, definite water system deficiencies were shown to exist during the time when disease was transmitted. Similar water system deficiencies were noted during this evaluation of Kentucky water supplies, and are discussed in the preceding section. The requisites for repetition of the tragic epidemics of the past, namely vulnerable water supplies and persons infected with potentially waterborne diseases, are still present in Kentucky. Greater vigilance by health officials and the water supply industry is necessary in order to minimize public health risk from drinking water.

PROGRAM NEEDS

Authority

Statute

The Statute provides the Kentucky Department of Health with broad regulatory and investigative powers to supervise design, construction, operation, and maintenance of all public water supplies; to require compliance with Rules and Regulations duly issued by the Board of Health; and to issue enforceable orders under an "Abatement of Nuisances" section.

The Statute refers to both "public" and "semi-public" supplies, but does not define either. "Public" supplies are defined in Departmental

Regulations, however, to include all supplies serving the public. Only "private" supplies are excluded from the definition, hence all but private supplies are subject to Departmental regulation.

The Statute does not specifically include provision for promotion and orderly development of new public water supplies. Comprehensive community planning for optimum utilization of water and land resources is discussed in the Public Health Service publication, Recommended State Legislation and Regulations. Reference in the Statute to the desirability of such planning would be helpful.

It would be desirable if the Statute were to include language specifically authorizing the Department to regulate and supervise the treatment, bottling, and distribution of bottled drinking water. While Kentucky has established excellent bottled water policy requirements, statutory authority would reinforce its regulatory position.

Penalty provisions are provided in the Statutes to assure compliance with rules and regulations and Departmental Orders. Fines are specified to be not less than $10 nor more than $100 for each day's noncompliance. In view of the very serious public health problems which may be created by an improper public water supply, the penalty appears to be inappropriately low. KRS 211.992 provides that persons violating the Statutes or rules and regulations on Solid Waste Disposal shall be fined from $100 to $500 or shall be imprisoned for not more than 30 days or both. It would seem that the very immediate and widespread health effects resulting from improperly purified or contaminated drinking water would merit penalty provisions at least equal to those provided for inadequate solid waste disposal practices.

It has not been the general practice of the Division of Sanitary Engineering to envoke the enforcement provisions of the statute. A less formal procedure has evolved to obtain action on water supply problems. This procedure involves the issuance of "Boil Water" orders, warning that use of the supply in question may be hazardous to health. In all recent cases, informal conversations between the Director, Division of Sanitary Engineering, and the County Health Officer of the appropriate county have resulted in boil water orders being issued by the County Health Officer. Further enforcement proceedings are not pursued. No formal actions are taken to follow-up the order or to document that compliance has been obtained. When corrections have been made and the health hazard is no longer present, an announcement is made stating that the water has been shown to be safe by testing.

It is reported that approximately 10 boil water orders were issued in 1971, all of which were issued by County Health Officers. No reluctance to issue boil water orders has been evidenced, especially in response to natural disasters such as floods. This is considered appropriate use of a tool which experience has proven to be effective. There appears to be a need, however, for more forceful steps to be pursued in the event compliance is not obtained with the issuance of the boil water order. A boil water order has been in effect for approximately 7 years in one small public supply, and the order has been ignored without further action by the State Department of Health.

By letter of November 25, 1969, the Kentucky State Department of Health formally ordered the City of Covington to comply with fluoridation Regulations. Covington had violated Regulations by discontinuing fluoridation of the city water supply. The letter stated the following: "accordingly and consistent with Kentucky Public Water Supplies and Fluoridation Regulations pursuant to the authority of KRS Chapter 211, the City of Covington is hereby directed and ordered to re-initiate the fluoridation of the public water supply without further delay." (Emphasis added.) Two previous letters had "requested" that fluoridation be re-initiated. Covington did not comply, and at this writing, over two years from the date of the letter, fluoridation has not yet been resumed.

Legal recourse was available under KRS 211.990 to prosecute the City of Covington, but the Department of Health chose not to take this action, and no further steps were taken to obtain compliance. While this and other instances illustrate the underlying philosophy of the Department to obtain compliance through persuasion rather than enforcement, the unwillingness to carry through when the enforceable procedures were begun is not to the Department's credit. This absence of definitive action to assert the Department's preeminence in public health matters has weakened its credibility and compromised its effectiveness.

Regulations

The latest revision of the Public Water Supplies Regulations was adopted July 20, 1967. Improvements needed to this relatively recent updating relate primarily to additional subjects and details which should be included.

As noted in the preceding section, few provisions are included which provide for the promotion and orderly development of new supplies. While specific requirements for comprehensive community planning could not be reasonably included in Regulations, reference to planning activities in a preface or discussion section may promote more logical and orderly development of public water supplies.

The Regulations require that "plans and specifications on public water supplies constructed by the State or political subdivision thereof shall be prepared by an engineer or architect registered in the State of Kentucky." It is suggested that plans and specifications for all public water systems, regardless of ownership, be prepared by a professional engineer registered in Kentucky.

In order to assure continued maintenance and safe operation of all water supplies serving the public, it is essential that an individual or legally constituted group be designated as responsible for the supply. Without such a designation, proceedings to enforce elimination of hazards to health are ineffective.

Although not specifically granted in the Statute, authority for review and approval of plans for construction of water systems includes approval of the source of supply. Approval of the source should include determination of adequacy of both quantity and quality. The Regulations should specify that water quality and quantity data be assembled to allow assessment of the adequacy of the water supply source in relation to current and reasonable future demands.

The Kentucky Water Pollution Control Commission has adopted water quality criteria for surface waters suitable for use as source of domestic supply. These criteria prescribe limits for many constituents of health significance. The Department's Public Water Supply Regulations, however, do not include raw water standards. Standards published in the Public Health Service's Manual for Evaluating Public Drinking Water Supplies, and the Federal Water Quality Administration's Water Quality Criteria are recommended to supplement the Standards of the Kentucky Water Pollution Control Commission.

The Regulations do not restrict bathing, boating or other activities in or near waters used as source of public supply. While the Division of Sanitary Engineering has developed and is enforcing a policy on this matter, it is recommended that consideration be given to including it in future Regulations.

Finished water standards are included in the Regulations, and have been adapted with certain changes from the 1962 Public Health Service Drinking Water Standards. This feature of the Regulations is particularly commendable. Nevertheless, certain aspects of this portion of the Regulations need improvement. The bacteriological standards section of the Regulations references the Drinking Water Standards, and indicates the bacteriological limits are the same in both documents. However, the wording of the Regulation is paraphrased from the

Drinking Water Standards, and while quantitative features are retained, clarity has been decreased by the paraphrasing. Further, several words have been omitted, probably inadvertently, which has added to the difficulty of interpretation. Bacteriological sampling location is properly specified as "representative points throughout the distribution system." The number of samples needed to "determine properly the bacteriological quality of the water supply" is not specified, however, and this omission is considered crucial. The bacteriological sampling frequency specified for the distribution system in the Drinking Water Standards is recommended as "minimum."

The chemical and radiochemical standards present constituent limits identical to those in the Drinking Water Standards. However, introductory wording for these standards has not clearly defined those constituent limits which are aesthetic considerations and those which cannot be exceeded without endangering public health. Wording more closely corresponding to the Drinking Water Standards is recommended. The physical standards are satisfactory.

Bacteriological and chemical laboratory facilities considered necessary for each type or class of water supply should be specified, as should the type, number, and frequency of raw and finished water examinations.

The definition of a cross-connection does not specifically include situations which may result in contamination by waters of unknown quality or steam and other gases. The following definition is suggested:

> Any physical connection or arrangement between two otherwise separate piping systems, one of which contains potable water and the other either water of unknown or questionable safety, or steam, gas or chemical, whereby there may be a flow from one system to the other, the direction of flow depending on the pressure differential between the two systems.

Chlorination equipment is discussed in detail in the Regulations. However, it is not specifically stated that chlorination or other disinfection is mandatory for all public water supplies. Mandatory disinfection has been a firm policy of the Division of Sanitary Engineering for many years, and a statement to that effect in the Regulations is recommended. The Regulations should require that those systems practicing chlorination maintain a detectable free chlorine residual in all parts of the water distribution system. Chlorine residual measurement should be in accordance with the latest edition of Standard Methods.

Regulations should incorporate the provisions of the August 1971 policy memorandum, "Bottled Water Requirements," and should specify bacteriological and chemical quality criteria for bottled water. Frequency and type of bacteriological and chemical testing should also be specified.

The Ten State Standards[3] are suggested as a guide in revision of the Kentucky Water Supplies Regulations.

/3 Recommended Standards for Water Works, Great Lakes - Upper Mississippi River Board of State Sanitary Engineers.

Policy

The Division of Sanitary Engineering has developed and promoted many excellent policies and design standards over the years. The Division is to be particularly commended for the strong positions taken with regard to conservative design and operation of water supply facilities. Written records of many of these policies are found only in letters from the Director, Division of Sanitary Engineering, to specific water supplies in response to a particular problem or question. Others, such as "General Design Criteria for Ground and Surface Water Supplies" are written as general documents.

It is unfortunate that all policy documents have not been assembled and written in a form suitable for general distribution. Many of the policies relate to design criteria, which would be useful to consulting engineers and others preparing plans for construction or modification of water system facilities. It is recommended that consideration be given to development of a comprehensive policy and design criteria document.

Activities

Engineering

The findings of this evaluation and documents prepared by the Director, Division of Sanitary Engineering, emphasize that the Kentucky Water Supply Program is not providing the engineering services necessary to fulfill its responsibilities as specified in the Statute. A portion of a memorandum from the Director, Division of Sanitary Engineering to the Kentucky Commissioner of Health accurately summarizes this conclusion and is quoted below:

> "Due to the continuing budgetary restrictions and shortage of engineering and clerical personnel, the services now offered by the Division of Sanitary Engineering in the protection and promotion of public water supplies ... are below minimal."

The field surveys made in this evaluation have shown this statement to be correct. The deficient engineering services evidenced themselves in unprotected sources of supply, deficient treatment facilities, deficient treatment operation, inadequate quality control, finished water quality failing to meet established Drinking Water Standards, and inadequate cross-connection control.

The primary need of the engineering surveillance phase of the Kentucky Water Supply Program is sufficient personnel, thoroughly trained and deployed throughout the State. Given sufficient personnel, a secondary need would be to thoroughly evaluate, organize and implement existing program activities. The lack of staff has necessitated repeated compromises between what the Division, in its professional judgement, considers to be an adequate level of surveillance and regulation, and what can be provided with existing resources. Important program activities at times are not performed. Perhaps even more critical, however, is the fact that performance of certain program activities has become so hurried or incomplete as to be ineffective. Many engineering inspections are superficial. Return inspections to review compliance with previously made recommendations are seldom made. The problem extends beyond field visits and includes handling and follow-up of bacteriological reports, monthly operating reports and review of plans and specifications. A Water Supply Program conducted in this manner promotes a false sense of security regarding the reliability of water systems in Kentucky.

Comprehensive water system information is needed to establish operator certification, sampling and engineering surveillance requirements. Additional information is particularly needed for those systems which purchase and distribute treated water from parent systems.

The engineering surveillance of fluoridation was also found to be deficient. Major deficiencies in facilities, equipment, and operational practices were found in water systems thought to be providing dental health benefits to the residents of Kentucky.

The attempt to establish a regional office for the western portion of the State has not been fully implemented. The Regional Office presently located in Earlington has never been staffed and equipped to carry out an effective regional program. Because of long travel times involved in servicing the entire State from a single central location, a regional office arrangement is essential for quick response within the State.

The operator training activity and mandatory operator certification regulation has affected a major proportion of the larger water systems in the State. Of the 36 systems surveyed in this study, 16 had certified operators, 16 had non-certified operators, and 4 did not have an identifiable operator. Field survey results, however, show that many of the systems operated by trained personnel have significant deficiencies. (See Appendix A, Table VI). Eleven (11) of 16 systems with certified operators had a risk factor of 3 or greater. Yet the trained operators appeared to perform somewhat better than those not trained. For example, 19 of 20 systems without a certified operator had a risk factor of 3 or greater, and all 7 supplies for which a bacteriological record could not be established were operated by non-certified operators. Therefore, the significant time and effort devoted to short school training and operator certification appears to have made some impact in conveying the message of public health protection to the water supplies. Much remains to be done, however, as can be seen from the number of supplies whose risk factors are high and from the number of supplies not yet reached by the program. It is recommended that a regional short school program be implemented in order to bring the training location within commuting distance of all operators.

Environmental Protection Agency experience indicates that it takes an average of 1.2 man-days to perform a comprehensive field survey of a water system facilities and operation. This time requirement for a single visit does not include making arrangements for field work or preparation of written reports. Moreover, it does not include important follow-up work with local officials, development of programs for facilities improvement or instruction of operators.

These latter activities are necessary if the surveys are to be an effective tool in securing adequate facilities and proper operation. It has been estimated that, on the average[4], at least four man-days per year are required for each public water supply for plans review, meetings with governing bodies, surveys, report writing, review of operational and water quality reports, training, etc. Cross-connection control activities are excluded from this estimate because this activity is primarily related to distribution system size. It is also estimated that "semi-public" water systems require approximately one-fourth as much time (one day per supply per year) as is required for public water supply surveillance.

The following assumptions were used to estimate the personnel requirements for the administration of a fully satisfactory Water Supply Program in Kentucky.

1. 313 public water supply systems (including treatment and distribution).
2. Four man-days/public water supply/year.
3. 110 "Distribution Only" public water supplies.
4. Two man-days/distribution-only system/year.
5. 1800 "semi-public" water systems.
6. One man-day/"semi-public" system/year.

/4 Community Water Supply Survey, 1969, p.62.

7. Cross-connection control for public water systems based on the following:

Population Served by System	Engineering Time Man-day/System/Year
50,000 and over	4
10,000 to 49,999	3
1,000 to 9,999	2
less than 1000	1
Distribution only[5]	1

8. 220 man-days = one man-year

Based on these assumptions, the annual personnel required are:

Public water supply: 313 systems x 4 $\frac{\text{man-days}}{\text{system}}$ = 1252

Distribution only systems: 110 systems x 2 $\frac{\text{man-days}}{\text{system}}$ = 220

"Semi-public" supply: 1800 systems x 1 $\frac{\text{man-day}}{\text{system}}$ = 1800

Cross-connection control:

Population	No. Systems	Man-days System	Man-days Group
50,000 and over	8	4	32
10,000 to 49,999	18	3	54
1,000 to 9,999	151	2	302
less than 1,000	136	1	136
Distribution Only[5]	110	1	110
Subtotal			634
Total			3906

/5 Population estimates were not available for all "distribution only" systems.

The total annual personnel time for engineering field activities is 3,906 man-days, or approximately 18 man-years of professional time. This represents an increase of 14 man-years of professional time over that available from the present staff. In order to provide adequate clerical support for the professional staff, approximately one clerical employee is needed for each three professionals. Therefore, a clerical staff of six (6) is necessary for the Water Supply Program. This represents an increase of 4 clerical positions over the present staff level.

Laboratory

(Bacteriological)

Bacteriological sampling is an essential part of the Water Supply Program. The need for this activity is supported by the bacteriological findings of this study. Only 13 of the 36 supplies studied had collected the minimum number of samples specified in the Drinking Water Standards each of the previous 12 months. Seven (7) supplies had collected no samples in the previous 12 months. Seventy (70) percent of the public supplies studied either failed one or more months to analyze the number of samples specified in the Drinking Water Standards, or failed the bacteriological quality provisions of the Standards one or more months. Refer to Appendix F for details of the survey of the bacteriological laboratory.

The principle needs of the bacteriological surveillance program are:

a. Consistent sampling of all public water supplies at the level prescribed by the Drinking Water Standards.

b. Consistent critical evaluation and recording of sample data by the Division of Sanitary Engineering staff.

c. Procedures to assure immediate resampling and follow-up when unsatisfactory sample results are encountered.

d. Evaluation and certification of all bacteriological laboratories that analyze drinking water.

Consistent bacteriological sampling was not demonstrated by the findings of the field surveys or the examination of records in the Frankfort office. This results from the fact that the Water Supply Program has not required an adequate bacteriological sampling frequency be maintained. While the current program may provide acceptable surveillance for small supplies serving less than 2,500 people, it does not provide a satisfactory check for most larger systems. Revision of the Water Supply Program's bacteriological sampling policy is indicated. It is recommended that State Laboratories examine monthly from each supply either (a) at least 10 percent of the distribution system samples required by the Drinking Water Standards, or (b) twc samples, whichever is greater.

Remaining samples required by the Drinking Water Standards should be analyzed in treatment plant laboratories certified by the State, or, in the case of small supplies without laboratory capability, in the State laboratories.

Evaluation and certification of all laboratories examining bacteriological quality of drinking water is considered necessary for the proper operation of the Water Supply Program (See Sections 3.13 and 3.14 of the Drinking Water Standards). The Kentucky Laboratory Certification Program is a function of the Division of Laboratory Services. This program has certified the Department of Health laboratory in Frankfort and 6 other laboratories which are involved in the Interstate Carrier Water Supply Program. Seventeen (17) additional water system and County Health Department laboratories are also certified. The Kentucky Laboratory Certification Program thus attempts to bring all laboratories doing drinking water bacteriology in the State up to acceptable standards. The Program is to be commended for this effort, and is encouraged to bring any water bacteriology laboratories not yet certified into the program.

Serious deficiencies were found in the engineering review, follow-up and record keeping of bacteriological sampling results reported to the Division of Sanitary Engineering. Recent losses of experienced personnel and overall reduction in staff has caused necessary daily review of results reported from the laboratory to be performed sporadically and in an unsystematic manner. For several periods of time, essentially no engineering review and/or filing of reports from the laboratories were done. Under these circumstances, serious bacteriological problems could occur undetected and uncorrected. Those supplies submitting samples to the State program for bacteriological analysis and engineering review may interpret the absence of notification of bacteriological problems as an indication that the State has judged water quality to be satisfactory. This may not be the correct conclusion. A bacteriological surveillance program which does not provide evaluation and follow-up of results creates a false sense of security.

The practices of the Division of Sanitary Engineering relating to resampling and follow-up in response to bacteriological samples showing contamination were not in conformance with those specified in the Division's Rules and Regulations. In the recent past when review of bacteriological sampling results detected a contaminated sample, the supply was requested to submit three resamples collected the same day from the point which yielded the contaminated sample. The Drinking Water Standards and State Regulations specify a somewhat different procedure. Daily check samples should be collected from the same sampling point until the results from two consecutive samples show the water to be of satisfactory quality.

Immediate action should also be taken to locate and correct the cause of the contamination. It is particularly important that elapsed time between determination of contamination by the laboratory and notification of the supply that resampling is necessary be kept as short as possible. This requires telephone notification rather than mail service. Preferably, resampling should begin the same day laboratory results become available. This requires close communication between the Division of Sanitary Engineering and the laboratory.

In order to perform the additional work indicated in this section, it is estimated that one additional bacteriologist and one additional records clerk are needed by the laboratory.

(Chemical)

Chemical surveillance of drinking water assumes increasing importance as more sources of raw water are subject to municipal, industrial and agricultural waste discharges. The need for increased service in chemical surveillance is indicated by the findings of this study. All but two of the public supplies examined had received a chemical evaluation in the past three years. However, most of the chemical analyses included only 10 of the 26 constituents listed in the Drinking Water Standards.

The policy of the Division of Sanitary Engineering stipulates that "routine" chemical analyses shall be performed annually on each public supply, and a "complete" chemical analysis shall be performed every four years. Records maintained by the Division were not amenable to a systematic check to determine the extent to which this policy was followed. However, it appeared, judging from the total number of analyses performed by the laboratory, that reasonable compliance had been maintained with the routine sampling policy, but that few complete analyses were run. Refer to Appendix G for details of the chemical laboratory survey.

The principle needs of the chemical surveillance program are:

a. Record keeping procedures to assure continual updating of the file and facilitate systematic checks of the date and type of previous chemical analyses.

b. Additional professional and clerical help in the laboratory to handle increased number of complete chemical analyses.

c. A revised policy specifying the frequency and type of chemical determinations which shall be made for each public water supply.

It is recommended that drinking water samples be collected and analyzed according to the following schedule unless more frequent analyses are indicated by the presence of excessive levels of harmful constituents:

(1) Surface (river) - at least twice per year

(2) Surface (lake) - at least one per year

(3) Ground (well or spring) - at least once each three years.

These analyses should include all constituents listed in the Drinking Water Standards.

Filing and record keeping procedures should be revised to allow easy determination of which supplies have been checked according to the prescribed schedule and which supplies are due for another examination. Moreover, it is recommended that a form and procedures be developed so that the report form prepared by the laboratory may constitute the permanent record of the results. The present procedure of re-typing laboratory reports requires much clerical time and provides opportunity for mistakes.

Additional staff will be needed by the laboratory to perform trace metals, pesticides and radiochemical analyses required by the sampling schedule recommended above. It is estimated that two additional chemists and one clerk are needed to adequately handle the work.

Data Processing

Fully satisfactory administration of a water supply surveillance program requires the acquisition, evaluation and storage of a vast quantity of information. In order to determine the information processing method best suited to the needs of the Kentucky Water Supply Program, an estimate was made of the total amount of information that must be handled in one year. Four major areas of program responsibility were considered - bacteriological surveillance, chemical surveillance, engineering inspections, and monthly operating reports. Making assumptions that these four program activities would be performed in an optimum manner as described elsewhere in this report for the 423 public water supplies, it was determined that over three million items of information must receive some degree of review by Water Supply Program staff. Further, approximately 100,000 of these items should be retained and be continuously available for reference or analysis. This estimate does not include information handled in connection with other aspects of the program such as engineering plans review and surveillance of semi-public and individual water systems.

From the above, it is evident that an immense quantity of data must be handled for successful management of a Water Supply Program. It appears that the portion of this data requiring systematic storage and availability could best be handled with automatic data processing techniques. This activity could utilize the State Health Department's Data Processing Center. Contact with the Data Processing Center has established that equipment and personnel are available.

Automatic data processing would provide an effective means to evaluate water supply data, summarize information statewide, and identify problems. Automatic equipment can perform these important screening and summarization functions, allowing the professional staff to concentrate on problem areas and remedial actions.

Resources

Organization

In the past, the Water Supply Program was the principal environmental activity in the Department of Health. During the intervening years, however, a number of environmental programs were begun and grew, eventually achieving Divisional status. At this writing, the Division of Sanitary Engineering stands as one of the six environmental divisions. At the federal as well as the state level, the growth and activity in the newer environmental programs have acted to obscure the Division of Sanitary Engineering.

Personnel

In response to increases in the number of people served by public water supplies, the Division of Sanitary Engineering grew in staff and budget until the mid 1960's. Other aspects of the environment, however, such as water pollution control, air pollution control, and solid waste management, began to occupy more favored status in the Department as federal funding for these activities became available. Despite continuing increases in numbers of water supplies and people served, the Water Supply Program actually declined such that the 1971 staff was barely one-half of the staff employeed in 1966. See Table II. Also illustrated by Table II is the essentially constant level of funding for the Division. A

TABLE II

MANPOWER AND FUNDING - FISCAL YEARS 1961-1971

Fiscal Year	Manpower				Total Funds
	Engr.	Engr. Vac.	Clerical	Abolished	
61	5	3	2		$ 95,018
62	8	2	3		114,705
63	9	0	3		109,150
64	9	0	3		112,957
65	8	2	3		115,935
66	9	1	3		120,178
67	7	2	3	1	123,438
68	7	3	3		124,580
69	7	1	3	2	119,187
70	7	0	3	1	133,831
71	5	0	2	3	103,075

constant appropriation actually amounted to a decrease in the level of services which could be delivered due to rapidly inflating costs during those years.

Not only has the Water Supply Program staff decreased in numbers, but a disrupting personnel turnover has been experienced. The following tabulation clearly illustrates how key staff departures weakened the program, since replacement personnel generally had less water supply experience than those they replaced.

Year Left	Engineer	Years Water Supply Experience
1964	Keith O. Schwab	5
1965	Richard Smith	4
1966	Harold Snodgrass	5
1966	Charles Inglehart	5
1966	Harry Marsh	3
1966	W. W. Smither	8
1966	Jerry Huston	5
1967	Herman Regan	7
1969	Ora Main	2
1970	Brents Dickinson	8

Personnel requirements of the Water Supply Program can be divided into two categories: those assigned to the Division of Sanitary Engineering and those assigned to supporting laboratory functions.

As developed in the Activities - Engineering portion of this section, it has been determined that the minimum staff considered necessary to administer an effective Water Supply Program is 18 professional and

6 secretarial positions. This staffing level is designed to meet present needs and makes no allowance for increased needs of the future. In the interest of economy and for efficient use of sanitary engineering talent, public health representatives or other non-engineering personnel might be substituted for some sanitary engineering staff. However, such substitutions should be approached with caution and probably should not exceed 25 percent of the overall staff.

In order that there may be a focal point within the water supply program for coordination of important technical activities, it is proposed that certain senior staff members be designated technical consultants for specific subjects. Examples of such specialties would be Cross-Connection Control, Treatment Plant Design, Manpower Development and Training, and Fluoridation. These consultants would be charged with the responsiblity of keeping current in their respective specialties and providing assistance, training, and coordination in their activity throughout the State. While several of these specialties could well be full time jobs, other specialists might also be assigned general staff functions.

In order to provide assurance that essential work in support of the Water Supply Program will be performed at the increased levels recommended in this report, it is proposed that the Water Supply Program fund several positions in the Division of Laboratory Services. As discussed in this section, one bacteriologist and one clerk are needed by the bacteriological laboratories. In addition, two chemists and one clerk are needed by the chemistry laboratory.

Deployment

The Earlington Regional Office was established in 1961 in order to provide economies in travel and personnel time and to make possible better service to the western portion of Kentucky. Decentralization provides opportunity for quicker response to problems, and allows for more frequent contact and hence greater familiarity with circumstances pertaining to public water supplies.

It is recommended that the Water Supply Program be more fully decentralized as a complete staff is recruited and trained. The Earlington office should eventually be staffed with at least two professionals and one secretary. Similarly, regional offices should be established to serve other sections of the State, such as Somerset or Corbin in the southeast, and Ashland in the northeast. It is recommended that each regional office be staffed with at least two professionals and one secretary. It is further recommended that regional boundaries and location of regional offices be coordinated with other programs of the State Department of Health.

Budget Requirements

Personnel costs of the recommended Water Supply Program are estimated at approximately $369,000 based upon current salary levels. Travel, space, equipment and supplies may cost as much as $54,000 additional.[6] These figures do not include bacteriological laboratory or chemical

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/6 Community Water Supply Study p. 62.

laboratory costs, but costs of proposed positions to be funded by the Water Supply Program are included.

It is estimated that the Division of Laboratory Services examined approximately 20,300 water samples for bacteriological contamination in fiscal year 1971. The cost of these analyses has never been calculated, or has any cost been charged to the Water Supply Program for this service. The analyses are conservatively estimated to have cost at least $40,600. Bacteriological analyses for the proposed program may number as high as 40,000 per year. This is about 19,700 more than are presently examined and could cost as much as $39,400 more than current program, $24,000 of which is covered by the two proposed positions to be funded by the Water Supply Program.

It is also estimated that about 500 complete chemical analyses will be required each year for the proposed programs. Based on an estimated cost of $150[7] per sample and deducting chemical laboratory personnel costs already included above, the chemical analyses may cost as much as $35,000.

The total estimated cost of the proposed Water Supply Program is summarized in the following tabulation:

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WATER SUPPLY PROGRAM PROPOSED BUDGET

Water Supply Program Personnel	
18 Professional and 6 Clerical	$305,000
Personnel Assigned to Laboratories 3 Professional and 2 Clerical	64,000
Travel, Space, Equipment and Supplies	54,000
Indirect Laboratory Costs	
40,000 Bacteriological Analyses	56,000
500 Chemical Analyses	35,000
	$514,000

The cost of the current Water Supply Program is estimated as follows:

CURRENT WATER SUPPLY PROGRAM BUDGET

Water Supply Activities	82,500
Indirect Laboratory Costs	52,500
	$135,000

The proposed Water Supply Program amounts to a 3-fold increase over what is now being spent for water supply protection. Viewed in another way, it may be said that the current Kentucky program only provides one-third of what is needed.

The importance of a strong Water Supply Program cannot be escaped. The health and life of every Kentucky resident and visitor depends upon the availability of safe drinking water. Because the protection of drinking water is so crucial to a healthful environment, it must be supported at its proper level of personnel, funds and laboratory services.

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The following persons and/or agencies made a major contribution to the successful completion of this study.

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APPENDICES

A. Public Water Supply Survey Data

B. Semi-Public Water Supply Report

C. Individual Water Supply Report

D. Fluoride Practice

E. Water Supply Code and Regulations

F. Bacteriological Laboratory Survey

G. Chemistry Laboratory Survey

H. Waterborne Disease Occurrence

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G. Chemistry Laboratory Survey

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APPENDIX A

TABLE I

PUBLIC WATER SYSTEMS STUDIED

NO	NAME OF SYSTEM	POPULATION SERVED	AVERAGE DAILY DEMAND (MGD)	SOURCE	TREATMENT /1
1	Benton	3,074	0.41	2 Wells	DLFI
2	Boone Co. W. D.	4,800	0.22	Covington	-
3	Bowling Green	39,000	6.00	Barren River	CSFDLF1
4	Bradfordsville	560	0.03	N. Rolling Fork R.	D
5	Bromley W.D.	1,130	0.07	Covington (Ludlow W.D.)	-
6	Campbell Co. W.D. #1	44,000	2.74	Newport	DP
7	Campton	720	0.03	2 Wells	AFDL$_A$F1
8	Catlettsburg	10,000	1.20	Big Sandy River	CSFDLT&O
9	Cold Springs W.D.	1,900	0.13	Covington	-
10	Corbin	12,500	1.39	Laurel River	ACSFDLT&OF1
11	Covington	60,000	6.85	Ohio River	ACSFD$_A$LT&O
12	Dixon	540	0.05	Dixon Lake	CSFDL$_A$T&OL
13	Elkton	2,800	0.16	Stinson Lake	CSFDLF1T&O
14	Florence W.D.	11,000	0.91	Kenton Co. W.D. #1	-
15	Fulton	3,500	0.65	3 Wells	ADLP
16	Gamaliel	720	0.04	Line Creek	CSFDL

TABLE I (Cont'd)

PUBLIC WATER SYSTEMS STUDIED

NO	NAME OF SYSTEM	POPULATION SERVED	AVERAGE DAILY DEMAND (MGD)	SOURCE	TREATMENT /1
17	Henry Co. W.D. #1	1,200	0.08	Henry Co. W.D. Lake	CSFDL$_A$T&O
18	Highland Heights W.D.	4,000	0.13	Newport (CCWD)	-
19	Jenkins	4,500	0.60	Jenkins Lake, Well	CSFDLF1
20	Kenton Co. W.D. #1	52,700	5.67	Licking River	CSFDLF1T&O
21	Kingswood	200	Unknown	2 Springs	D
22	Leatherwood (Blue Diamond Coal Co.)	690	0.13	Mine Imp.	FDL$_A$P
23	Lexington	172,507	23.00	Kentucky R.	ACSFDLF1T&O
24	Louisville	672,585	112.90	Ohio River	CSFD$_A$L$_A$RF1T&O
25	Ludlow W. D.	6,200	0.41	Covington	-
26	Mentor W. D.	700	0.03	Newport	-
27	Newport	31,300	6.64	Ohio River	CSFDLT&O
28	Owensboro	58,800	7.98	25 Wells	ASFDLPF1
29	Sharpsburg W. D.	1,000	0.04	Sharpsburg Lake	CSFDLT&O
30	Silver Grove	1,500	0.24	2 Wells	CSDL$_A$
31	Somerset	16,700	1.70	Lake Cumberland	CSFDL$_A$F1

TABLE I (Cont'd)

PUBLIC WATER SYSTEMS STUDIED

NO	NAME OF SYSTEM	POPULATION SERVED	AVERAGE DAILY DEMAND (MGD)	SOURCE	TREATMENT /1
32	Taylor Mill W.D.	5,000	0.36	Covington	-
33	Walton	1,800	0.14	2 Lakes	CSFDLPT&O
34	Western Mason Co. W.D.	1,560	0.03	Well	D
35	Wilder W. D.	650	0.02	Covington	-
36	Winston Park W. D.	800	0.03	Covington	-
		1,230,636	147 gpcd Avg.		

/1

A - Aeration
C - Coagulation
S - Sedimentation
F - Filtration
D - Disinfection
D_A- Amoniation
L - Lime
L_A- Soda Ash
Fl- Fluoridation
P - Phosphates
T&O- Taste & Odor (Carbon)
R - Recarbonation

APPENDIX A

TABLE II

WATER QUALITY - PUBLIC WATER SYSTEMS

SYSTEM NO.	MONTHS BACTERIOLOGICAL STDS. NOT MET	CHEMICAL STANDARDS NOT MET /1			
		RECOMMENDED		MANDATORY	
		Plant	Distribution Sys.	Plant	Distribution Sys.
1	1 /3	0	0	0	0
2_{11}/2	1	See system 11 for source quality evaluation			
3	0	0	0	0	0
4	Unk. /4	0	0	0	0
5_{11}	0	See system 11 for source quality evaluation			
6_{27}	Unk.	See system 27 for source quality evaluation			
7	Unk.	Fe-0.629	Fe-0.95, 2.12 Mn .085	0	0
8	0	0	0	0	0
9_{11}	0	See system 11 for source quality evaluation			
10	0	0	0	0	0
11	0	0	0	0/5	0
12	0 /3	CCE - 0.581	Fe - .93 Mn - .27	0	0
13	0	0	0	0	0
14_{20}	Unk.	See system 20 for source quality evaluation			

TABLE II (Cont'd)

WATER QUALITY - PUBLIC WATER SYSTEMS

SYSTEM NO.	MONTHS BACTERIOLOGICAL STDS. NOT MET	CHEMICAL STANDARDS NOT MET /1			
		RECOMMENDED		MANDATORY	
		Plant	Distribution Sys.	Plant	Distribution Sys.
15	0	0	0	0	0
16	0 /3	0	0	0	0
17	0	0	Mn - 0.06	Se - 0.012	0
18_{27}	Unk.	See system 27 for source quality evaluation			
19	0 /3	Mn - .78	Mn - .066	0	0
20	0	0	0	0	0
21	11	0	0	0	0
22	0	0	Fe - 1.05	0	0
23	0	0	0	0	0
24	0	0	0	0	0
25_{11}	0	See system 11 for source quality evaluation			
26_{27}	Unk.	See system 27 for source quality evaluation			
27	0	0	0	0	0
28	0	0	Fe - .48	0	0
29	2	Turb. 13 s.u.	0	0	0

TABLE II (Cont'd)

WATER QUALITY - PUBLIC WATER SYSTEMS

SYSTEM NO.	MONTHS BACTERIOLOGICAL STDS. NOT MET	CHEMICAL STANDARDS NOT MET /1			
		RECOMMENDED		MANDATORY	
		Plant	Distribution Sys.	Plant	Distribution Sys.
30	1	0	0	0	0
31	0	0	0	0	0
32_{11}	1	See system 11 for source quality evaluation			
33	0 /3	CCE - 219 ppb	0	0	0
34	Unk.	0	0	0	0
35_{11}	0	See system 11 for source quality evaluation			
36_{11}	0	See system 11 for source quality evaluation			
#Not Meeting Standards	6	8		1	
Percent	16.7 % Failed Bact. Quality 16.7% Bact. Quality Unk.	22.2%		3%	

/1 *Only those chemical constituents failing to meet Drinking Water Standards are shown. Color and turbidity are expressed in Standards Units all other constituents expressed as mg/1.

/2 System No. 2_{11}, etc. - Designates distribution only system (2) purchases finished water from system (11)

/3 Incomplete data, samples collected at plant but not from distribution system

/4 Unk. - Bacteriological data not available at time of survey

/5 Chemical analyses of system No. 11 indicated possibility of mercury contamination. This system remains under special investigation.

APPENDIX A

TABLE III

FACILITIES - PUBLIC WATER SYSTEMS

SYSTEM NO	SOURCE			TREATMENT		DISTRIBUTION			QUALITY CONTROL		RISK FACTOR /1
	QUALITY	QUANTITY	PROTECTION	FACILITIES	OPERATION	STORAGE	PRESSURE	Cl_2 RESIDUAL	RECORDS & TESTS	X-CONN. CONTROL	
1	OK	OK	OK	X	X	OK	OK	OK	X	X	4
2_{11} /2	OK	OK	OK	NA	OK	OK /3	OK	OK	X	X	2
3	OK*	OK	X	OK	OK	OK	OK	OK	X	P	2
4	X	OK	X	X	X	OK	OK	OK	X	X	6
5_{11}	OK	OK	OK	NA	X	OK /3	OK	OK	X	X	3
6_{27}	OK	OK	OK	OK	X	X /3	OK	OK	X	X	4
7	OK	OK	OK	X	X	OK	OK	OK	X	X	4
8	X	OK	X	X	OK	OK	OK	OK	X	X	5
9_{11}	OK	OK	OK	NA	X	OK /3	X	OK	X	X	4
10	OK*	OK	X	X	X	OK	OK	X	X	X	6
11	OK	OK	OK	X	OK	OK	OK	OK	OK	X	2
12	X	OK	OK	X	X	OK	OK	X	X	X	6
13	OK	OK	OK	X	X	OK	OK	X	X	X	5
14_{20}	OK	OK	OK	NA	X	OK /3	OK	OK	X	X	3
15	OK	OK	OK	X	OK	OK	OK	OK	X	X	3
16	OK	OK	X	X	X	OK	OK	X	X	X	6

TABLE III (Cont'd)

FACILITIES - PUBLIC WATER SYSTEMS

SYSTEM NO	SOURCE			TREATMENT		DISTRIBUTION			QUALITY CONTROL		RISK / FACTOR
	QUALITY	QUANTITY	PROTECTION	FACILITIES	OPERATION	STORAGE	PRESSURE	Cl_2 RESIDUAL	RECORDS & TESTS	X-CONN. CONTROL	
17	OK*	OK	X	X	X	OK	OK	OK	OK	X	4
18_{27}	OK	OK	OK	NA	X	X /3	OK	OK	X	X	4
19	OK*	X	X	X	X	OK	OK	X	X	X	7
20	OK	OK	OK	OK	OK	OK	OK	OK	OK	X	1
21	X	X	X	X	X	X	X	X	X	X	10
22	OK*	OK	OK	X	X	X	OK	OK	X	X	5
23	OK	OK	OK	OK	OK	OK	OK	OK	OK	P	0
24	OK	OK	OK	OK	OK	OK	OK	X	OK	P	1
25_{11}	OK	OK	OK	NA	X	OK /3	OK	OK	X	X	3
26_{27}	OK	OK	OK	NA	X	X /3	OK	OK	X	X	4
27	OK	OK	OK	X	OK	X	X	OK	OK	X	4
28	OK	OK	OK	X	X	X	OK	OK	X	X	5
29	OK	OK	OK	X	X	OK	OK	X	X	X	5
30	OK	OK	X	X	X	OK	OK	OK	X	X	5
31	OK	OK	OK	X	OK	OK	OK	X	OK	X	3
32_{11}	OK	OK	OK	NA	X	OK /3	OK	OK	X	X	3

TABLE III (Cont'd)

FACILITIES - PUBLIC WATER SYSTEMS

SYSTEM NO	SOURCE			TREATMENT		DISTRIBUTION			QUALITY CONTROL		RISK /1 FACTOR
	QUALITY	QUANTITY	PROTECTION	FACILITIES	OPERATION	STORAGE	PRESSURE	Cl_2 RESIDUAL	RECORDS & TESTS	X-CONN. CONTROL	
33	OK	OK	OK	X	X	OK	OK	OK	X	X	4
34	OK	OK	OK	X	X	OK	OK	X	X	X	5
35_{11}	OK	OK	OK	NA	X	OK /3	OK	OK	X	X	3
36_{11}	OK	OK	OK	NA	X	OK /3	OK	OK	X	X	3
TOTAL "X"	4	2	9	21	26	7	3	10	29	33	
PERCENT	11.1%	5.6%	27.8%	58.4%	72.6%	19.4%	8.3%	27.8%	80.6%	91.7%	

* - Subject to upstream pollution
X - Deficient
P - Partial Program
NA - Not Applicable

/1 - Judged on the ten facility items - "0" Facility deficiencies = least risk
"10" Facility deficiencies = most risk

/2 - System No. 2_{11}, etc. - Designates distribution system (2) purchases finished water from system (11).

/3 - Storage Adequacy based on capability of parent and dependent systems

APPENDIX A

TABLE IV

PUBLIC WATER SUPPLY SURVEILLANCE

SYSTEM NO.	BACT. LABS. TYPE	BACT. LABS. CERTIFIED	NUMBER OF BACT. SAMPLES REQUIRED /1	NUMBER OF BACT. SAMPLES EXAMINED Avg./2	NUMBER OF BACT. SAMPLES EXAMINED Range/Month	MONTHS WITH NO SAMPLES	YEARS SINCE LAST SHD SURVEY	YEARS SINCE LAST CHEMICAL ANAL.
1	SHD	Yes	4	< 1	0 - 1	10	< 1	2
2_{11} /3	WTP	Yes	5	13	5 - 21	0	None	2
3	SHD	Yes	50	32	17 - 50	0	1	1
4	SHD	Yes	2	0	0	12	3	3
5_{11}	WTP	Yes	2	(See System No. 25)			None	2
6_{27}	WTP	Yes	55	Unk.	Unk.	Unk.	None	< 1
7	SHD	Yes	2	0	0	12	2	2
8	SHD-WTP	SHD Only	12	4	4 - 5	0	1	1
9_{11}	WTP	Yes	2	5	2 - 11	0	None	2
10	SHD-WTP	Yes	13	10	8 - 12	0	2	2
11	SHD-WTP	Yes	72	133	109 - 153	0	2	2
12	SHD	Yes	2	0	0	12	1	2
13	SHD	Yes	3	< 1	0 - 2	7	2	< 1
14_{20}	WTP	Yes	12	Unk.	Unk.	Unk.	None	1

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TABLE IV (Cont'd)

PUBLIC WATER SUPPLY SURVEILLANCE

SYSTEM NO.	BACT. LABS.		NUMBER OF BACT. SAMPLES			MONTHS WITH NO SAMPLES	YEARS SINCE LAST	
	TYPE	CERTIFIED	REQUIRED /1	EXAMINED			SHD SURVEY	CHEMICAL ANAL.
				Avg. /2	Range/Month			
15	SHD	Yes	4	< 1	0 - 2	6	1	1
16	SHD	Yes	2	0	0	12	2	2
17	SHD	Yes	2	2	2 - 3	0	1	1
18_{27}	WTP	Yes	5	Unk.	Unk.	Unk.	None	< 1
19	SHD	Yes	5	0	0	12	3	2
20	SHD-WTP	Yes	62	72	Unk.	0	4	1
21	SHD	Yes	2	1	1 - 2	0	< 1	4
22	SHD	Yes	2	1	0 - 3	7	3	1
23	SHD-WTP	Yes	140	157	144 - 180	0	< 1	< 1
24	SHD-CHD-WTP	Yes	260	315	280 - 359	0	1	2
25_{11}	WTP	Yes	7	22	9 - 41	0	None	2
26_{27}	WTP	Yes	2	Unk.	Unk.	Unk.	3	< 1
27	SHD-WTP	Yes	40	115	108 - 120	0	1	< 1
28	SHD	Yes	70	11	8 - 13	0	4	< 1

TABLE IV (Cont'd)

PUBLIC WATER SUPPLY SURVEILLANCE

SYSTEM NO.	BACT. LABS.		NUMBER OF BACT. SAMPLES			MONTHS WITH NO SAMPLES	YEARS SINCE LAST	
	TYPE	CERTIFIED	REQUIRED /1	EXAMINED			SHD SURVEY	CHEMICAL ANAL.
				Avg. /2	Range/Month			
29	SHD	Yes	2	1	0 - 5	3	2	1
30	SHD	Yes	2	< 1	0 - 3	2	< 1	< 1
31	SHD-WTP	Yes	19	22	22 - 23	0	1	2
32_{11}	WTP	Yes	6	14	7 - 32	0	None	2
33	SHD	Yes	2	0	0	12	None	< 1
34	SHD	Yes	2	0	0	12	6	9
35_{11}	WTP	Yes	2	6	2 - 9	0	None	2
36_{11}	WTP	Yes	2	6*	0 - 14	2	None	2
				#Deficient = 23 64%			#>1 = 24 66.7%	#>3 = 2 5.6%

SHD - State Health Department
WTP - Water Treatment Plant
CHD - County Health Department
* - See months with no samples

/1 - Minimum number of samples required to meet Drinking Water Standards

/2 - Average number of samples examined per month during the 12-month period preceding the study

/3 - System No. 2_{11}, etc. - Designates distribution system (2) purchases finished water from system (11)

APPENDIX A

TABLE V

SUMMARY OF PUBLIC WATER SYSTEM DEFICIENCIES

SYSTEM NO	WATER QUALITY /1	RISK FACTOR /2	SURVEILLANCE Bact.	SURVEILLANCE Chem.	SURVEILLANCE SHD	LAST STATE RATING/3
1	B	4	X	OK	OK	Provisional
2_{11}/4	B	2	OK	X	X	Not Rated
3		2	X	OK	OK	Approved
4		6	X	OK	X	Not Rated
5_{11}		3	-	X	X	Not Rated
6_{27}		4	X	X	X	Not Rated
7	C	4	X	OK	X	Provisional
8		5	X	OK	OK	Approved
9_{11}		4	OK	X	X	Not Rated
10		6	X	OK	X	Approved
11	/5	2	OK	OK	X	Approved
12	C	6	X	OK	OK	Provisional
13_{20}		5	X	OK	X	Approved
14		3	X	X	X	Not Rated
15		3	X	OK	OK	Approved
16		6	X	OK	X	Provisional
17	C+C*	4	OK	OK	OK	Approved
18_{27}		4	X	X	X	Not Rated
19	C	7	X	OK	X	Provisional
20		1	OK	OK	X	Approved
21	B	10	X	X	OK	Unapproved
22	C	5	X	OK	X	Not Rated

TABLE V (Cont'd)

SUMMARY OF PUBLIC WATER SYSTEM DEFICIENCIES

SYSTEM NO	WATER QUALITY /1	RISK FACTOR /2	SURVEILLANCE Bact.	Chem.	SHD	LAST STATE RATING/3
23		0	OK	OK	OK	Approved
24		1	OK	OK	OK	Approved
25_{11}		3	OK	X	X	Not Rated
26_{27}		4	X	X	X	Not Rated
27		4	OK	OK	OK	Approved
28	C	5	X	OK	X	Approved
29	B & C	5	X	OK	X	Provisional
30	B	5	X	OK	OK	Provisional
31		3	OK	OK	OK	Approved
32_{11}	B	3	OK	X	X	Not Rated
33	C	4	X	OK	X	Approved
34		5	X	X	X	Provisional
35_{11}		3	OK	X	X	Not Rated
36_{11}		3	X	X	X	Not Rated
Total	13	30 ≥ 3	23	13	24	
Percent	36.2%	83.4%	64%	36.1%	66.7%	

/1 B - Exceeded bacteriological standard at least once in 12 months

C - Exceeded at least one "recommended" chemical limit

C*- Exceeded at least one "mandatory" chemical limit

/2 Judged on ten facility items "0" deficiencies = least risk
"10" deficiencies = most risk

X - Inadequate or deficient

/3 State Rating based on sanitary survey of water system.

/4 System No. 2_{11}, etc. Designates distribution system (2) purchases finished water from system (11).

/5 Chemical analyses of system No. 11 indicated possible mercury contamination. This system remains under special investigation.

APPENDIX A

TABLE VI

PUBLIC WATER SUPPLY OPERATORS AND OPERATION

SYSTEM NO	OPERATOR FULL TIME	OPERATOR TRAINING	OPERATOR CERTIFIED	WATER QUALITY	RISK FACTOR /1
1	No	Short School	Yes	B	4
2_{11}/2	Yes	On-the-Job	No	B	2
3	Yes	College	Yes		2
4	Yes	On-the-Job	No		6
5_{11}	None		No		3
6_{27}	Yes	On-the-Job	No		4
7	Yes	Short School	No	C	4
8	Yes	Short School	Yes		5
9_{11}	Yes	On-the-Job	No		4
10	Yes	Short School	Yes		6
11	Yes	College	Yes	/3	2
12	Yes	On-the-Job	No	C	6
13	Yes	Short School	Yes		5
14_{20}	No	On-the-Job	No		3
15	No	Short School	Yes		3
16	Yes	Short School	No		6
17	Yes	Short School	Yes	C & C*	4
18_{27}	No	On-the-Job	No		4
19	No	Short School	Yes	C	7
20	Yes	Short School	Yes		1
21	No	On-the-Job	No	B	10
22	No	On-the-Job	No	C	5
23	Yes	Short School	Yes		0

TABLE VI (Cont'd)

PUBLIC WATER SUPPLY OPERATORS AND OPERATION

SYSTEM NO	OPERATOR FULL TIME	OPERATOR TRAINING	OPERATOR CERTIFIED	WATER QUALITY	RISK FACTOR /1
24	Yes	College	Yes		1
25_{11}	No	On-the-Job	No		3
26_{27}	None		No		4
27	Yes	College	Yes		4
28	Yes	College	Yes	C	5
29	Yes	Short School	Yes	B & C	5
30	Yes	Short School	No	B	5
31	Yes	Short School	Yes		3
32_{11}	Yes	On-the-Job	No	B	3
33	No	Short School	No	C	4
34	No	On-the-Job	No		5
35_{11}	None		No		3
36_{11}	None		No		3
Summary	10 Part-time 4 No Operator 39% Not Full-time	15 Sh. Sch. 42% 12 Job 31% 5 College 14%	20 No 55.6%	13 Problems 36.2%	4.0 Avg.

/1 Judged on ten facilities items "0" deficiencies = least risk
"10" deficiencies = most risk

Water Quality

B - Exceeded bacteriological standard at least once in 12 months

C - Exceeded at least one "recommended" chemical limit

C*- Exceeded at least one "mandatory" chemical limit

/2 System No. 2_{11}, etc. - Designates distribution system (2) purchases finished water from system (11)

/3 Chemical analyses of system No. 11 indicated possibility of mercury contamination. This system remains under special investigation.

APPENDIX B

KENTUCKY SEMI-PUBLIC WATER SUPPLIES

According to the Kentucky Public Water Supplies and Fluoridation Regulations issued by the Kentucky State Department of Health, a public water supply is:

> "any water supply serving the public irrespective of its ownership or operation and made available for drinking and/or domestic use."

However, direct supervision of public water supplies by the Kentucky State Department of Health has been restricted, under administrative policy, to approximately 423 major water systems serving the public through municipal, private and water district systems. Except for review of plans and specifications, practically all other general supervision of the remaining public water supplies has been delegated to the County Health Departments in Kentucky. For the purpose of this report these systems, which are not included in the formal State Health Department surveillance program, will be referred to as "semi-public" water supplies. These supplies serve the public in a variety of private and commercial establishments, such as restaurants, motels, subdivisions, trailer courts, schools, parks, recreation areas, etc. While some plans and specifications are on file in the State Health Department, little or no operational information is available in that office for these "semi-public" systems. Some "semi-public" water supply operational information is available in individual County Health Department files, but significant gaps in knowledge remain. "Semi-public" water supplies may influence the health of many people and since, according to current State Statutes, these supplies are the direct responsibility of the Kentucky State Department of Health, they were included in the Kentucky Water Supply Study.

In order to evaluate the present condition of Kentucky "semi-public" water supplies and to ascertain if additional health agency surveillance may be necessary to assure protection of the public health, three counties were selected to be surveyed and sampled. The counties were Boyd County in east Kentucky, Russell County in central Kentucky, and McCracken County in west Kentucky. Although the sample was admittedly small, it was felt that conclusions drawn from these three counties could reasonably be extended to generally describe the conditions of "semi-public" water supplies in Kentucky.

Boyd County has a topography of rolling hills and is greatly influenced by the industrial economy of the Ohio-Big Sandy River Valley. Russell County also has a rolling topography and an agrarian economy but is moving toward a recreation-oriented economy centered around Lake Cumberland, a large impoundment on the upper reaches of the Cumberland River. McCracken County has the typical flat topography of the Jackson Purchase Area and is influenced by the urban center of Paducah.

"Semi-public" water supplies in Boyd and McCracken Counties are largely dependent on groundwater for a source of supply. Russell County, an unusual case, utilizes ground water and surface water from Lake Cumberland on about a 50-50 basis. Boyd and Russell Counties, as is most of Kentucky, are underlain with limestone formations which present the following problems to a water system:

(a) limited sustained water yield

(b) subject to fracture and solution channels which may allow extensive movement of contaminated ground water.

This geologic condition may cause properly constructed and operated wells to yield contaminated water. McCracken County is underlain with a massive sand and gravel acquifer yielding water of high capacity and excellent quality.

The study attempted to establish an estimate of the number of persons affected by "semi-public" water supplies in the State. In many cases, the number of persons actually served by such a supply is not a matter of record. In addition, the probability that water will be consumed differs between guests at a motel and visitors at a day facility such as a recreation park. Nevertheless, visitors to both facilities are dependent upon the water served as the only water available. All visitors were included, therefore, in defining the population at risk. Assumptions employed in obtaining the estimated population at risk are included at the end of this Appendix.

Table I presents a tabulation of the principle features of the "semi-public" water supplies surveyed in the three-county area. This tabulation includes information on the estimated number of people served, source, treatment provided, surveillance by a health agency, and quality of water produced. Also included is a rating of the overall acceptability of the system from a general public health standpoint. Obviously, some judgment was necessary to rate the adequacy of treatment and degree of sanitary defects. However, emphasis in rating the systems was placed upon results of chemical and bacteriological testing and presence of chlorinating equipment and chlorine residual.

Sufficient data were not assembled to evaluate adequately whether or not a particular water supply could be operated safely without disinfection. However, it is the policy of the Kentucky State Department of Health to require disinfection of all public water supplies for public health protection. The Environmental Protection Agency also endorses disinfection of all public water supplies. Since "semi-public" water supplies are included under Kentucky Law as a public water supply, they should provide the same level of public health protection. Therefore, for the purpose of this Study, disinfection is judged necessary for a supply to be considered fully satisfactory. Supplies considered "satisfactory" in all other respects except for the absence of chlorine equipment or chlorine residual were considered "questionable".

Conclusions

1. Based on information collected during the study, it is estimated that approximately 1,800 "semi-public" water

supplies are operating in Kentucky. It is further estimated that 2.5 million persons (Kentucky residents and the traveling public) are exposed in one or more instances to drinking water from these "semi-public" water supplies during one year's time. This significant number of persons who are or may be affected by the quality of the water requires that a stronger program for supervision of these supplies be established.

2. Of the 59 "semi-public" water supplies surveyed and sampled, a significant percentage revealed the presence of bacteriological or chemical contamination.
   (a) Thirty-nine (39) percent showed the presence of coliform organisms. Twenty-one (21) systems (35.6%) failed the bacteriological standard and 5 percent showed the presence of fecal coliform organisms. These deficient systems serve an estimated 17,971 people annually.
   (b) Twenty (20) systems (34%) failed the chemical standards and one system failed to meet the mandatory chemical limits. These deficient systems serve an estimated 13,326 people annually.
   (c) Only 17 percent of the "semi-public" water systems surveyed and sampled could be given an overall "satisfactory" rating.

3. Thirty-seven (37) percent of the supplies surveyed had not been visited by a health agency official in the previous two years. Most health agency surveillance was provided by county sanitarians who are not fully trained in maintenance and operation of water treatment facilities. In most cases, the visit consisted of collection of a water sample and did not include significant inspection of facilities or operational practices.

Recommendations

The Kentucky Water Supply Program should:

1. Under authority granted in Section 211.090(1)(d) and 211.180 of the Kentucky Revised Statutes, include all water supplies serving the public, as defined by the Kentucky Public Water Supplies and Fluoridation Regulations, under the present and future programs.
2. Provide minimum standards for construction, including protection of source, size and type of storage facility, disinfection equipment, and distribution system.
3. Provide for initial plan review and approval, inspections of facilities and operations at least annually, and a bacteriological sampling program which provides for submission of at least two samples monthly for all supplies serving the public.
4. Enforce mandatory disinfection of all water supplies serving the public.

Assumptions for Calculating Annual Populations at Risk

1. Family campgrounds and travel trailer parks operate 120 days per year at 50 percent of capacity. Average length of stay is three days per family with an average of four (4) visitors per family.

2. Tourist and truck stop restaurants operate 300 days per year. Daily customers average six times seating capacity and customers average four visits per year.

3. Hamburger stands operate 200 days per year. Daily customers average 10 visits per year.

4. Lunch counters and bars are open 300 days per year. Customers average four times seating capacity and average 40 visits per year.

5. Evening meal only restaurants located in recreation areas average 120 days per year operation. Daily customers average one per seat capacity and customers return an average of four times per year.

6. Trailer parks and subdivisions risk only residents. Likewise, schools risk only teachers and students.

7. Motels operate 180 days a year at 60 percent capacity. The average customer (3 people) stays 2 days.

8. Club houses are occupied to capacity four times per year.

9. Golf courses operate 240 days per year. Customers return an average of 10 times per year.

Calculations of Annual Population at Risk

In Russell County, the estimated annual population at risk was divided by the number of supplies surveyed, yielding 4,270 persons at risk annually per supply. A similar calculation for Boyd and McCracken counties yields 760 and 630 persons per supply at risk annually. Averaging these three figures yields approximately 1,420 persons annually at risk per "semi-public" supply.

There is no inventory of "semi-public" water supplies available in Kentucky. Therefore, it is necessary to arrive at a total estimate based on knowledge gained during the survey. The three counties studied during this survey averaged 20 "semi-public" water supplies. However, based on the facts that Boyd and McCracken Counties are highly developed around large urban centers and Russell County is strongly influenced by a large recreation lake, it was decided that the average number of "semi-public" supplies for these three counties is too high to be used on a statewide basis. Therefore, it is estimated that 15 "semi-public" supplies per county is a reasonable number for Kentucky.

One hundred and twenty counties with fifteen (15) supplies serving 1,420 persons annually comes to 2,540,000 persons whose health may be affected by "semi-public" water supplies each year.

TABLE I - SUMMARY OF PRINCIPLE FEATURES OF SUPPLIES SURVEYED

BOYD COUNTY SUPPLY	POPULATION SERVED		SOURCE			TREATMENT			SURVEILLANCE	QUALITY			RATING		
	Est. Daily Pop. at Risk	Est. Annual Pop. at Risk	Adeq. Qty.	Type	Free From Visible Sanitary Defect	Auto. Equip. to Chlor.	Chlor. Resid. Detect.	Addit.* Treat.	Health Agcy. Visit In Prev. 2 Yrs.	Total Coli.	Fecal Coli.	Esthetic Accept.	Satis.	Ques.	Unsatis
Bobs Salads	11	11	Yes	W	No	Yes	0	-	Yes	0	0	Yes		X	
Boyd County High School	1,235	1,235	Yes	W	Yes	Yes	0	-	Yes	0	0	Fe-.52			X
Cannonsburg Elem. School	379	379	Yes	W	Yes	Manual	0	-	Yes	140	1	Yes			X
Cannonsburg Grade School	209	209	Yes	W	No	Yes	0	-	Yes	0	0	Fe-.33			X
Cadie's Drive-In	100	750	Yes	W	No	No	-	-	No	7	0	Mn-.15 Fe-16.83			X
Cedar Knoll Golf Club	53	1,260	Yes	W	Yes	No	-	-	No	0	0	Fe-2.5			X
Davis Marine Trailer Park	40	40	Yes	W	Yes	Yes	0	-	Yes	4	0	Iron			X
Durbin Elementary	68	68	Yes	W	Yes	Yes	0	-	Yes	0	0	Yes		X	
Edison School	355	355	Yes	W	Yes	Yes	0	-	Yes	0	0	Mn-.12 Fe-1.68			X
Garner School	176	176	No	W	No	Yes	0	-	Yes	0	0	Fe-.53			X
J. J. Restaurant	200	1,500	Yes	W	Yes	No	-	-	No	12	0	Yes			X
Mary's Lunch	100	750	Yes	Cist.	No	Manual	2.0	Fp	No	0	0	Yes	X		
Ponderosa Golf Course	17	416	Yes	W	Yes	Yes	0	-	No	0	0	Mn-.12 Fe-.54			X
Rankins Rest. & Gen. Store	211	3,440	Yes	W	Yes	Manual	0	Sf	Yes	0	0	Mn-.15 Fe-2.10			X
Rolling Meadows Golf Course	37	900	Yes	W	Yes	No	-	-	No	0	0	Yes		X	
Star 60 Restaurant	195	1,332	Yes	W	Yes	No	-	-	No	0	0	Fe-1.56			X
Star 60 Trailer Park	20	20	Yes	W	Yes	No	-	-	Yes	15	0	Fe-.54			X
Sundowner Golf Course	23	540	Yes	W	Yes	No	-	Fp	No	0	0	Mn-.98 Fe-.46			X
Twin Valley Golf Course	45	1,080	Yes	4 W	Yes	No	-	-	No	1	1	Fe-.80			X
TOTAL	3,474	14,461													

*See Explanation of Symbols Below

TABLE I - SUMMARY OF PRINCIPLE FEATURES OF SUPPLIES SURVEYED

	POPULATION SERVED		SOURCE			TREATMENT			SURVEILLANCE	QUALITY			RATING		
McCRACKEN COUNTY SUPPLY	Est. Daily Pop. at Risk	Est. Annual Pop. at Risk	Adeq. Qty.	Type	Free From Visible Sanitary Defect	Auto. Equip. to Chlor.	Chlor. Resid. Detect.	Addit.* Treat.	Health Agcy. Visit In Prev. 2 Yrs.	Total Coli.	Fecal Coli.	Esthetic Accept.	Satis.	Ques.	Unsatis
Ben Woods Bar No. 2	150	1,125	No	Sp.	No	No	-	-	Yes	0	0	Yes		X	
Crestview Subdivision	90	90	Yes	W	Yes	Yes	UK	-	Yes	0	0	Iron	X		
Fremont Elementary School	170	170	Yes	W	Yes	No	-	-	Yes	16	0	Yes			X
Hill Top Barbecue	50	375	No	Cist.	No	No	-	-	Yes	8	0	Mn-.14			X
Maple Leaf Motel	30	3,240	Yes	W	No	No	-	-	Yes	220	0	Yes			X
McGruder Village	60	60	Yes	W	Yes	Yes	0.0	-	Yes	0	0	Yes		X	
Ragland School	76	76	No	W	No	No	-	-	No	0	0	Pb-.37 Fe-.52			X
St. John's Church & School	166	166	Yes	W	No	No	-	-	Yes	800	10	Cu-1.12 Fe-.42			X
Sea Breeze Bar (Jack & Moms BBQ)	100	750	Yes	W	Yes	No	-	-	No	4	0	Yes			X
West Ky. Wildlife Mgmt. Area (Hunt Club)	20	240	Yes	W	Yes	Yes	0.0	Sf.	No	0	0	Iron		X	
TOTAL	912	6,292													

Others (Not Surveyed)
Bill & Margie's Barbecue
Chief Parduke Gun Club
Franklin Grocery
Coon Hunters Club

TABLE I - SUMMARY OF PRINCIPLE FEATURES OF SUPPLIES SURVEYED

	POPULATION SERVED		SOURCE			TREATMENT			SURVEILLANCE	QUALITY			RATING		
RUSSELL COUNTY SUPPLY	Est. Daily Pop. At Risk	Est. Annual Pop. at Risk	Adeq. Qty.	Type	Free From Visible Sanitary Defect	Auto. Equip. to Chlor.	Chlor. Resid. Detect.	Addit.* Treat.	Health Agcy. Visit In Prev. 2 Yrs.	Total Coli.	Fecal Coli.	Esthetic Accept.	Satis.	Ques.	Unsatis
Alligator Boat Dock No. 1	182	7,280	Yes	Surf	Yes	Yes	0.8	F	Yes	0	0	Yes	X		
Creamy Whip	42	612	Yes	W	No	Yes	0.4	-	No	0	0	Yes	X		
Cumberland Campground	100	4,000	Yes	Surf	Yes	Yes	0.0	F	Yes	80	0	Yes			X
Dunbars Store & Snack Bar	84	604	Yes	W	Yes	Yes	0.0	-	No	0	0	Yes		X	
Farmers Mill Roadside Park	3	540	Yes	W	No	Yes	0.2	-	No	0	0	Sulphur Salt	X		
Flanagans Restaurant	120	900	Yes	Sp	Yes	No	-	-	Yes	20,000	0	Yes			X
Foleys Cafe & Texaco	88	608	Yes	W	No	Yes	0.0	-	Yes	24	0	Mn-.092			X
Foleys Camper Court	186	4,536	Yes	Cist.	Yes	Yes	0.0	-	Yes	0	0	Yes		X	
Harbor Springs Subdivision	32	32	Yes	Sp	No	Yes	0.0	-	No	0	0	Yes		X	
Hubbards Drive-In	200	1,500	Yes	W	No	Yes	0.0	-	Yes	300	0	Yes			X
Indian Hills Camp	280	280	Yes	Surf	Yes	Yes	2.4	Fp	Yes	24	0	Turbid			X
Indian Hills KOA Campground	300	12,000	Yes	W	Yes	Yes	0.4	Fp	Yes	0	0	Turbid	X		
Jabez School	38	38	Yes	W	Yes	Yes	0.0	-	Yes	200	0	Yes			X
Jetts Grocery & Restaurant	64	454	No	W	Yes	Yes	0.0	-	Yes	8	0	Yes			X
Lake Cumberland Motel	18	1,620	Yes	W	No	Yes	0.0	-	Yes	0	0	Yes		X	
Lake Cumberland State Park	600	43,560	Yes	Surf	Yes	Yes	0.6	CSF	Yes	0	0	Yes	X		
Lakeside Subdivision	60	60	Yes	Sp	No	Yes	0.0	-	No	76	0	Iron			X
Lakewood Country Club	50	1,200	Yes	Surf	Yes	Yes	0.0	F	No	0	0	Mn-.11 Color			X
Lei-Hi Lodge & Restaurant	86	3,615	Yes	Sp	No	Yes	1.2	F	Yes	0	0	Yes	X		
McQuery's Mobile Court	32	32	Yes	W	Yes	Yes	0.0	-	No	0	0	Fe-.97			X
Pinecrest Mobile Park	200	200	No	W	Yes	Yes	0.0	-	Yes	40	0	Yes			X
Pleasant Hill - Lilly Creek	12	12	Yes	Sp	Yes	No	-	-	No	0	0	Zn-5.13			X
Pleasant Hill (O. L. Hughes)	44	44	Yes	Surf	Yes	Yes	0.0	Fp	Yes	0	0	Turbid Fe-0.65			X
Pleasant Hill Water System	56	56	Yes	Sp	Yes	Yes	0.0	-	No	92	0	Yes			X
Popplewells Fishing Camp	80	1,820	No	Sp	No	Yes	1.0	-	Yes	16	0	Yes			X

TABLE I - SUMMARY OF PRINCIPLE FEATURES OF SUPPLIES SURVEYED

RUSSELL COUNTY SUPPLY	POPULATION SERVED		SOURCE			TREATMENT			SURVEILLANCE	QUALITY			RATING		
	Est. Daily Pop. at Risk	Est. Annual Pop. at Risk	Adeq. Qty.	Type	Free From Visible Sanitary Defect	Auto. Equip. to Chlor.	Chlor. Resid. Detect.	Addit.* Treat.	Health Agcy. Visit In Prev. 2 Yrs.	Total Coli.	Fecal Coli.	Esthetic Accept.	Satis.	Ques.	Unsatis.
Royville Trailer Court	12	12	Yes	W	Yes	No	-	-	No	0	0	Yes		X	
Salem School	350	350	Yes	2 W	Yes	Yes	1.8	-	Yes	0	0	Yes	X		
Sandy's Drive-In	50	375	Yes	W	Yes	Yes	0.1	-	Yes	12	0	Yes			X
Union Chapel School	265	265	Yes	2 W	No	Yes	0.0	-	Yes	0	0	Iron		X	
Yellow Jersey (Ice Cream)	50	1,000	Yes	W	Yes	Yes	0.2	-	Yes	0	0	Yes	X		
TOTAL	3,684	86,605													

Treatment Symbols*

C - Chemical Coagulation
F - Gravity Sand Filtration
Fp - Pressure Filtration
S - Sedimentation
Sf - Softening
UK - Information Unknown

APPENDIX C
Kentucky Rural Individual Water Supplies

Kentucky State Department of Health water supply rules and regulations do not pertain to rural individual water systems. A private water supply is defined as "a residential water supply located on private property under the control of the homeowner, the use of which is limited to members of his family". The State Department of Health has prepared a brochure entitled How to Build a Rural Water Supply and provides other general technical assistance for rural individual water systems. However, the local health department, through its county sanitarian, is responsible for assistance to rural individual water supply owners on water quality, structural adequacy, and overall operation. Assistance is rendered only at the request of the private system owner. The county sanitarian does not have authority to require public health improvements, and thus, inferior or unsafe systems may be used for many years.

Rural individual water supplies serve approximately 35.5 percent of the total population of Kentucky or about 1.2 million people. Because such a significant number of Kentucky citizens obtain their drinking water from this type of system, any study of drinking water in Kentucky would be incomplete without consideration of rural individual water systems.

A special study was designed to assess the adequacy of rural individual water systems and the quality of water consumed by rural residents. Three county areas were selected to be surveyed and sampled. These counties were Lawrence County in eastern Kentucky, Madison County in central Kentucky,

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and Butler County in western Kentucky. The goal of the survey was to sample at least 500 rural individual systems in the three counties. While these water systems represent only about 0.2 percent of the total rural systems in Kentucky, it was felt that the geographic and geologic distribution were such as to reasonably describe the condition of rural individual water systems in Kentucky.

The study was conducted under a special contract with the Southern Regional Education Board. SREB provided four college students who performed the field surveys with equipment and technical assistance provided by the Environmental Protection Agency. In all, some 540 rural individual water systems were surveyed by the SREB summer interns. The survey consisted of a visit to each household, completion of a questionnaire listing specific data on the water system, and the collection of water samples for bacteriological and chemical analyses. All questionnaire and quality data was fed into the EPA data processing center and is the basis for this report.

Lawrence County has a rolling to mountainous terrain, typical of the Appalachian area of eastern Kentucky. Its economy is slightly depressed as is most of the Appalachian area, but is maintained at a reasonable level by the Ashland, Kentucky - Huntington, West Virginia industrial complex. Madison County has a ridge and valley terrain whose economy is greatly influenced by its proximity to the Lexington metropolitan area and two institutions of higher education. Butler County has a somewhat flatter terrain with a basic agricultural economy.

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Rural individual water supplies in Kentucky are largely dependent on groundwater from wells and springs as a source of supply. These water sources are greatly influenced by geological conditions of the area which dictate the quantity and quality of water produced. Most of the State of Kentucky is underlain with limestone formations. This geologic condition presents fractured channels which may allow extensive movement of undesirable water.

Table I presents a summary of water systems surveyed. Most of the individual water systems in Lawrence and Butler Counties obtain their drinking water from ground water sources through springs and wells. A number of Madison County individual water systems also obtain water from springs and wells, but because of inadequate groundwater resources in many areas, the majority of Madison County's rural water systems have had to resort to cistern supplies. Cistern systems may utilize rainwater collected directly from the home rooftop and/or water hauled from other private or public systems.

The findings on water quality are presented in Table II and III and are based on the collection of a bacteriological and chemical samples collected from each rural water system. The results of these samples indicate that rural individual water systems, in general, provide water of very poor bacteriological quality, and a large percentage of the private water systems have high levels of the undesirable chemical constituents namely, iron and manganese. Seventy (70) percent of the 540 water systems had evidence of total coliform contamination and approximately two-thirds of these systems had evidence of fecal coliform contamination.

There appeared to be variation of bacteriological quality among the counties surveyed. Lawrence County had a lower incidence of total coliforms as compared to Butler or Madison Counties. This is probably because of the larger percentage of drilled wells utilized in this county instead of the more susceptible springs and dug wells. Conversely, Butler County had the highest incidence of fecal coliform contamination and Madison County had the lowest. These findings also relate to the different types of water systems found in these counties. Butler County has a large number of springs and dug wells which are extremely susceptible to recent fecal pollution. Madison County has a large number of cistern supplies which are extremely susceptible to contamination, but will confine the water for a period of time long enough to allow for fecal coliform die-off.

There is also some variation of chemical quality among the counties surveyed. The presence of iron and manganese is common for ground waters which serve as major sources of supply for rural individual water systems. However, Madison County has a lower incidence of high iron and manganese than the other counties. The primary reason for this lower occurrence is the large percentage of cistern supplies in Madison County. This can be explained by either of the following:

(a) The cistern supply collects rainwater directly from the rooftop which, depending upon rooftop composition, may contain very little iron or manganese.

(b) Water may be hauled to the cistern from a source which is free of iron and manganese.

(c) Even if water hauled to the cistern supply does have iron and manganese, the cistern provides an opportunity for these minerals to settle out or oxidize.

However, along with the low incidence of iron and manganese, the Madison County supplies exhibited a majority of the health-related chemical constituents which were found in the rural individual water systems. Again, the existence of these constituents - cadmium, lead, and mercury - is thought to be due to the cistern supplies, or rather, the materials used in the construction of cisterns and rooftop catchment systems. It is possible that these metals may have leached from the materials or paints used to construct these facilities.

The limited occurrence of two other metallic substances - copper and zinc - in the rural individual water systems in Kentucky is thought to be possibly the result of these materials being dissolved from the piping within the system.

The major water quality deficiencies are summarized in Table IV. This table shows that:

(1) Seventy (70) percent of the rural systems had water of poor bacteriological quality. Approximately 1,900 people are exposed to this drinking water.

(2) Forty-three (43) percent of the rural systems had water of poor chemical quality. Approximately 1,180 people drink this water.

(3) Eighty-five (85) percent of the rural water systems serving approximately 2,295 people were deficient in either bacteriological and/or chemical quality.

A summary of the pertinent data from the questionnaires on each of the 540 rural individual water systems is presented in Table V. This data indicates some of the reasons why the vast majority of the rural water systems were found to have unsafe or undesirable water quality. Construction deficiencies, inadequate sanitary protection, lack of disinfection, and lack of health surveillance are but a few of the problems with these systems. For instance, the study revealed that:

(1) Twenty (20) percent of the rural water systems sources were of insufficient quantity.

(2) Fifty-one (51) percent of the rural water systems had serious sanitary defects at their source of supply.

(3) None of the rural water systems chlorinate their water supply.

(4) Ninety-three (93) percent of the rural water systems do not provide any treatment of their water supply.

(5) Ninety-eight (98) percent of the rural water systems had not had a health agency visit in the last two years.

(6) Ninety-one (91) percent of the rural water systems had never been tested for bacteriological quality.

In spite of these statistics which document the inadequacies of rural water systems in Kentucky, 67 percent of the water system users indicated a preference for their present water system. Such user apathy stems from a lack of knowledge about the health considerations of the drinking water and the lack of surveillance by health agencies.

Recommendations

The Kentucky Water Supply Program should:

(1) Stimulate the development of new community water systems and extensions to existing systems to provide safe water to rural residents.

(2) Promote improved health surveillance and improvements to existing rural water systems through county health agencies.

(3) Develop further health education brochures on rural water supply to generate user interest in safe drinking water.

TABLE I

Types of Systems Studied in Kentucky Rural Survey

COUNTY	NUMBER OF SYSTEMS	TYPES OF WATER SYSTEMS						
		CISTERNS	SPRINGS	Wells				SURFACE SUPPLY
				DUG	DRIVEN	BORED	DRILLED	
BUTLER	200	16	24	64	0	0	94	2
LAWRENCE	178	0	10	41	1	0	125	1
MADISON	162	113	9	17	0	1	22	0
Total	540	129	43	122	1	1	241	3

TABLE II

Summary of Water Quality Results

A. Bacteriological

COUNTY	TOTAL SAMPLES	TOTAL COLIFORMS*		FECAL COLIFORMS*		% FECAL/TOTAL
		No. Pos.	% Pos.	No. Pos.	% POS.	
BUTLER	200	144	74.7	114	58.5	78.0
LAWRENCE	178	99	59.3	74	41.8	68.5
MADISON	162	121	76.1	57	37.8	49.5
Totals	540	364	70.0	245	47.0	66.8

*Excludes samples with unusual results

B. Chemical

COUNTY	NUMBER OF SAMPLES	Samples Exceeding Mandatory Limits, mg/1							Exceeds Recommended Limits, mg/l				
		Ba (1.0)	As (0.05)	Cd (0.01)	Cr+6 (0.05)	Pb (0.05)	Ag (0.05)	Hg (0.005)	As (0.01)	Cu (1.0)	Mn (0.05)	Fe (0.3)	Zn (5.0)
BUTLER	200	0	0	0	0	0	0	0	1	7	51	66	3
LAWRENCE	178	3	0	0	0	0	0	0	0	2	5	93	4
MADISON	162	0	0	2	0	5	0	3	0	0	17	29	2
Totals	540	3	0	2	0	5	0	3	1	9	127	188	9

TABLE III

Comparison of Water Sources and Water Quality

A. Bacteriological

COUNTY	CISTERN			SPRINGS			WELLS								
							All Wells			Dug Wells			Drilled Wells		
	No.	Positive Total Coliforms	Fecal Coliforms	No.	Total Coliforms	Fecal Coliforms	No.	Total Coli.	Fecal Coli.	No.	Total Coli.	Fecal Coli.	No.	Total Coli.	Fecal Coli.
BUTLER	16	12	7	24	24	23	158	110	77	64	61	51	94	48	26
LAWRENCE	0	--	--	10	10	7	167	93	57	41	37	32	125	53	31
MADISON	113	74	39	9	7	5	40	33	23	17	15	13	22	16	8
Totals	129	86 (66.7%)	46 (35.6%)	43	41 (95.3%)	35 (81.4%)	365	236 (64.6%)	157 (43%)	122	113 (92.5%)	96 (78.6%)	241	117 (48.5%)	65 (27%)

B. Chemical

COUNTY	CISTERNS			SPRINGS			WELLS		
	No.	Exceeds Mand.Std	Exceeds Rec.Std.	No.	Exceeds Man.Std	Exceed Rec.Sd	No.	Exceeds Man.Std.	Exceeds Rec. Stds.
BUTLER	16	0	4	24	0	7	158	0	77
LAWRENCE	0	--	--	10	0	5	167	3	96
MADISON	113	9	10	9	1	2	40	0	22
Totals	129	9 (7%)	14 (10.9%)	43	1 (2.3%)	14 (32.5%)	365	3 (0.8%)	195 (53.5%)

Table IV

Summary of Water Quality Deficiencies

County	Total Rural Water Systems	Water Systems Deficient In:			Total Systems with Deficient Water Quality	
		Bacteriological Quality Only	Chemical Quality Only	Bact. & Chem. Quality	Number	Percent
Butler	200	85	23	66	174	87.0
Lawrence	178	48	42	61	151	84.8
Madison	162	90	12	32	134	82.6
TOTALS	540	223	77	159	459	85.0
People Affected*	2700	1115	385	795	2295	

*Average - 5 people/system

TABLE V

Summary of Questionaire Data

COUNTY	Number of Systems	Source		Treatment		Surveillance		User Preference		
		Inadequate Quantity	Sanitary Defect Noted	Chlorine	Other	Health Agn. Visit	Bact. Sample	Pres. Supp.	Another or Imp. Pri.	PWS
Butler	200	30	138	0	8	0	37	161	15	20
Lawrence	178	17	68	0	13	7	1	125	41	6
Madison	162	62	70	0	18	1	10	75	5	73
Total	540	109	276	0	39	8	48	361	61	99
Percent		20.2%	51.1%	0%	7.2%	1.5%	8.9%	67%	11.3%	18.

APPENDIX D

Kentucky Water Supply Program Evaluation

ADEQUACY OF THE WATER FLUORIDATION CONTROL PROGRAM IN KENTUCKY

INTRODUCTION

The Commonwealth of Kentucky by Health Department Regulation #S-ENG-2-1 requires all water supplies serving cities of the 1st, 2nd, 3rd, and 4th class and water districts serving equivalent populations must be adjusted to contain within 1.0-1.5 mg/l fluoride for the protection of the dental health of the people served by the supply. The Regulation provides for procedures to be followed in obtaining approval to fluoridate a fluoride deficient water supply and the requirements which must be met relating to equipment, facilities and services. The Division of Sanitary Engineering of the State Department of Health is responsible for approval and surveillance of public water supplies in the State including all fluoridation installations.

On June 1, 1971, 109 public water supply systems practiced fluoridation in the State out of a total of 423 public water supplies. Four water supply systems (Beaver Dam, Ekron, Park City and White Plains Water District) used one or more water sources containing natural fluorides of 1.0 mg/l or higher. These systems served an estimated 3,000 persons (December 1969). No public water supply sources are reported containing natural fluorides greater than the 1.5 mg/l limit.

EVALUATION PROCEDURES

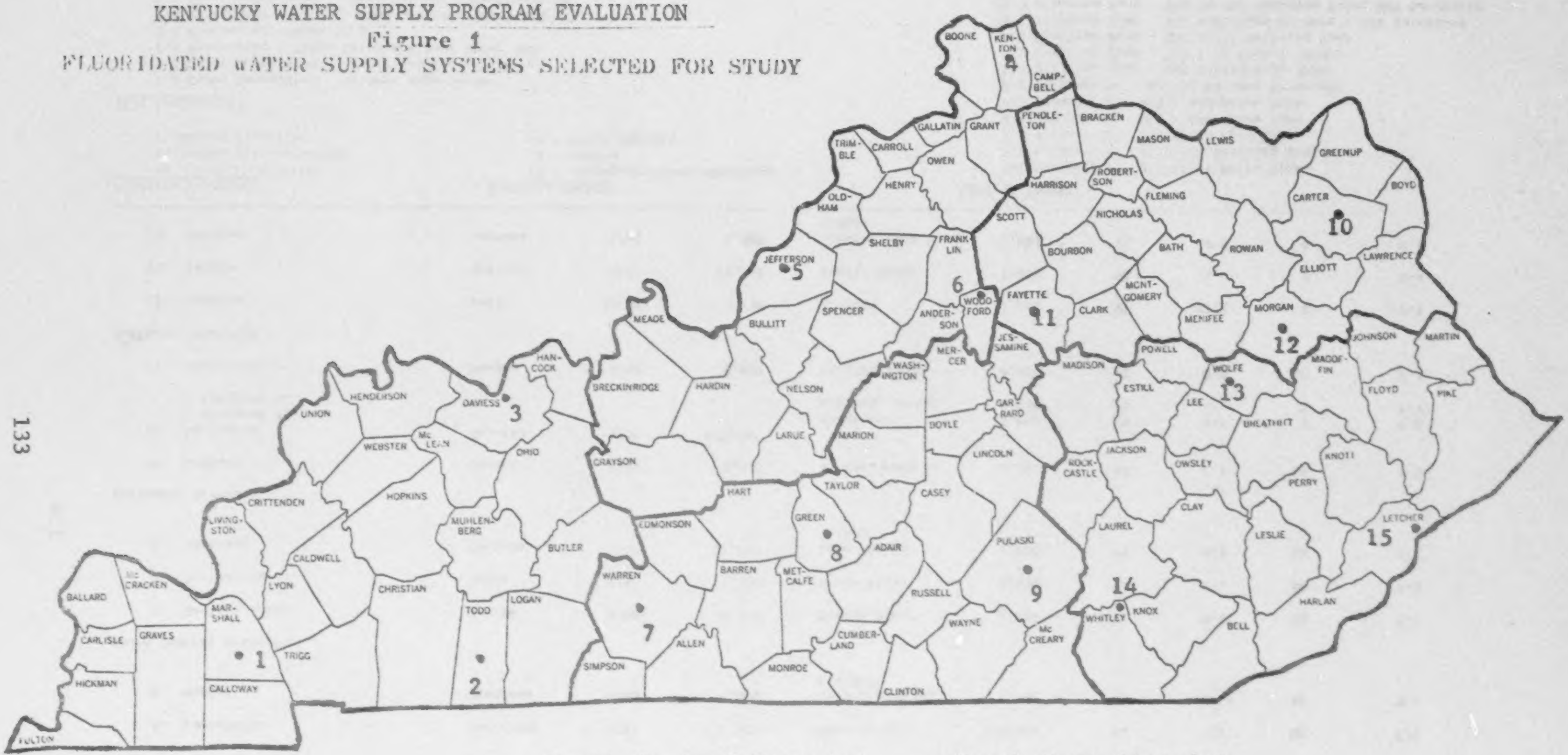
To evaluate the adequacy of the Kentucky State Department of Health's water fluoridation control program, fifteen fluoridated water supplies operating under the approval of the Division of Sanitary Engineering were selected for survey. The choice of the fifteen systems representative of the 109 fluoridation installations in Kentucky was made with the concurrence of the Division of Sanitary Engineering and was based on geographical location, population served, source of supply (ground water or surface), and fluoride compound used in fluoridation. Three water supply systems were chosen in each of the five Division of Sanitary Engineering Districts in the State to give representative geographical coverage. Selection based on the other parameters noted was made so the sample would have the same percentage of supplies meeting each parameter as occurred for all the 109 water supply systems fluoridating in the State (i.e., twenty-five percent of the 109 installations were feeding sodium fluoride as a source of fluoride ion; therefore, approximately twenty-five percent or four of the fifteen surveyed installations were feeding sodium fluoride). Figure 1, Fluoridated Water Supply Systems Selected for Study, locates the fifteen installations visited and Table I summarized pertinent information on each facility.

A field inspection visit was conducted at each of the fifteen fluoridated water supply systems selected for evaluation. Officials in charge of the installations were informed of the visit in advance.

KENTUCKY WATER SUPPLY PROGRAM EVALUATION

Figure 1

FLUORIDATED WATER SUPPLY SYSTEMS SELECTED FOR STUDY


BOONE
KENTON
4
CAMPBELL
PENDLETON
BRACKEN
MASON
LEWIS
GREENUP
BOYD
GALLATIN
GRANT
TRIMBLE
CARROLL
OWEN
HENRY
HARRISON
ROBERTSON
FLEMING
CARTER
10
OLDHAM
SCOTT
NICHOLAS
LAWRENCE
SHELBY
FRANKLIN
BOURBON
BATH
ROWAN
ELLIOTT
JEFFERSON
5
6
WOODFORD
FAYETTE
11
CLARK
MONTGOMERY
MENIFEE
MORGAN
12
JOHNSON
MARTIN
MEADE
BULLITT
SPENCER
ANDERSON
MERCER
JESSAMINE
POWELL
MAGOFFIN
HANCOCK
BRECKINRIDGE
HARDIN
NELSON
WASHINGTON
MADISON
ESTILL
WOLFE
13
FLOYD
PIKE
HENDERSON
UNION
DAVIESS
3
LEE
BREATHITT
WEBSTER
McLEAN
OHIO
LARUE
MARION
BOYLE
GARRARD
KNOTT
GRAYSON
LINCOLN
JACKSON
ROCKCASTLE
OWSLEY
PERRY
HOPKINS
CRITTENDEN
HART
TAYLOR
CASEY
CLAY
MUHLENBERG
LIVINGSTON
EDMONSON
GREEN
8
LAUREL
LESLIE
LETCHER
15
CALDWELL
BUTLER
ADAIR
PULASKI
BARREN
METCALFE
9
14
BALLARD
McCRACKEN
LYON
CHRISTIAN
WARREN
RUSSELL
KNOX
WHITLEY
HARLAN
MARSHALL
TODD
LOGAN
CUMBERLAND
WAYNE
McCREARY
BELL
CARLISLE
GRAVES
1
TRIGG
7
2
ALLEN
SIMPSON
MONROE
CLINTON
HICKMAN
CALLOWAY
FULTON

North Central District
4-Kenton Co. W.D. #1
5-Louisville
6-Midway

North East District
10-Grayson
11-Lexington
12-West Liberty

West District
1-Benton
2-Elkton
3-Owensboro

South Central District
7-Bowling Green
8-Greensburg
9-Somerset

South East District
13-Campton
14-Corbin
15-Jenkins

KENTUCKY WATER SUPPLY PROGRAM EVALUATION
TABLE I
FLUORIDATED WATER SUPPLY SYSTEMS SELECTED FOR STUDY

Water Supply System	Location (County)	Date of Fluoridation	Population Served	Source of Supply	Avg. Flow (MGD)	Fluoride Compound	Type of Feeder	Analysis Method	Test Equipment
West District									
1. Benton	Marshall	1/57	3,074	2-Wells	0.410	VS	V-3	SS	T-1
2. Elkton	Todd	4/64	2,800	Stinson Lake	0.160	VS	V-4	SS	T-1
3. Owensboro	Daviess	9/53	58,800	25-Wells	7.980	VS	V-4	SS	T-1
North Central District									
4. Kenton Co. W.D. #1	Kenton & Boone	7/67	61,700	Licking River	5.671	VS	V-1	S	T-4
5. Louisville	Jefferson	8/51	672,585	Ohio River	112.900	VS	G-1	MM	T-6
6. Midway	Woodford	8/66	1,600	Lees Branch Ch. & 1-Well	1.000	VT	PS-1	SS	T-1
South Central District									
7. Bowling Green	Warren	5/68	39,000	Barren River	6.000	VS	V-1	SS	T-1
8. Greensburg	Green	4/51	2,500	Green River	0.330	VA	P-1	SS	T-2
9. Somerset	Pulaski	2/67	16,700	Lake Cumberland	1.700	VS	V-3	SS	T-1
Northeast District									
10. Grayson	Carter	8/64	2,300	Little Sandy R.	0.285	VT	P-3	SS	T-1
11. Lexington	Fayette	4/54	172,507						
Richmond Rd.				Reservoir	13.000	VS	V-5	S	T-6
Kentucky R.				Kentucky River	10.000	VS	V-2	S	T-7
12. West Liberty	Morgan	4/62	2,000	Licking River	0.085	VT	P-2	SS	T-1
Southeast District									
13. Campton	Wolfe	10/70	720	2-Wells	0.030	VT	PS-2	S	T-3
14. Corbin	Whitley	2/67	12,500	Laurel River	1.390	VS	V-1	S	T-4
15. Jenkins	Letcher	1/69	4,380	Jenkins Lake & 1-Well	0.600	VS	V-3	S	T-5

Fluoride Compound:

VA- Fluosilicic Acid
VS-Sodium Silicofluoride
VT-Sodium Fluoride

Analysis Method:

MM - Megregian Maier (Modified)
S - Spadns
SS - Scott-Sanchis

Type of Feeder:

V-1 Volumetric - BIF 25-01 Helix Type
V-2 Volumetric - BIF 50-A Rotating Disk
V-3 Volumetric - W&T A-378 Roll Type
V-4 Volumetric - W&T A-690 Screw Type
V-5 Volumetric - W&T A-635 Screw Type
G-1 Gravimetric - BIF 31-02 Loss-in-weight
P-1 Diaphram Pump - W&T V-1190 Type [illegible]
P-2 Diaphram Pump - BIF 1-47 Chem-O-Feeder
P-3 Diaphram Pump - W&T A-747 Metering Pump
PS-1 Diaphram Pump - BIF 1205 Chem-O-Feeder; BIF Saturator
PS-2 Diaphram Pump - W&T 94-100 Metering Pump; W&T Saturator

Test Instrument:

T-1 Color Comparator - Hellige Aqua Tester
T-2 Color Comparator - Taylor Water Analyzer
T-3 Photometer - Delta Water Analyzer Model 260
T-4 Photometer - Hach DR-A
T-5 Photometer - Hellige Aqua Analyzer Model 950A
T-6 Spectrophotometer - Bausch & Lomb Spectronic 20
T-7 Automatic Analyzer - Hach CR-2024

Survey forms were completed[1] and water samples for fluoride analysis were collected at all facilities. However, one system, West Liberty, was found not to be fluoridating and therefore, the sample size was reduced to fourteen.

The actual level of fluoride in the distribution system is the single most important factor in evaluating the adequacy of a community water fluoridation effort and hence in evaluation of a State Water Fluoridation Control Program which is responsible for approval and surveillance of the installation. However, as distribution samples collected on one particular day may not give a true picture of day-to-day operating conditions at the facility, the following questions grouped in five major divisions were investigated:

I. Analytical Control of the Fluoride Level

   A. Were the fluoride analyses conducted at the water plant accurate within ±0.1 mg/l of the value determined by the Water Supply Programs Division, EPA?

   B. Were finished water samples analyzed daily or more frequently for fluoride content?

   C. Were raw water samples analyzed regularly for fluoride content?

   D. Were laboratory equipment and facilities at the water plant adequate to conduct fluoride analysis according to one of the three Standard Methods?

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[1] A copy of the questionnaire used in the Kentucky Fluoridation Survey is appended.

E. Was laboratory equipment clean and given responsible care? and,

F. Were complete records kept of the fluoridation operation?

II. Fluoride Feed Equipment and Facilities

A. Were the fluoride feed equipment and facilities adequate to control the fluoride level in the finished water to the desired level?

B. Was positive protection provided against overfeeding, was equipment location and point of fluoride application at the best practical site and was the feed equipment site uncluttered?

C. Was the fluoride feed installation operated continuously for the past twelve months without an interruption of more than one day? and,

D. Were the fluoride feed equipment and facilities maintained satisfactorily?

III. Fluoride Compound - Storage and Handling

A. Was the fluoride chemical compound stored in a safe, protected and orderly manner?

B. Was safety equipment available and were safe procedures followed in handling the fluoride compound? and,

C. Were fluoride compound shipping containers disposed of satisfactorily or re-used only for fluoride chemical storage?

IV. Operater Training and Interest

A. Was the treatment plant operator well-trained to operate the fluoride feed equipment and facilities?

B. Was the individual conducting the fluoride analyses knowledgeable of his test equipment and standard procedures for analysis? and,

C. Was the water plant official interviewed in favor of fluoridation and was he interested in adding fluorides to his water system?

V. Surveillance

A. Were check samples for fluoride analysis submitted to the State on a regular basis? and,

B. Had the water fluoridation installation surveyed been inspected by Division of Sanitary Engineering personnel in the past twelve months?

SUMMARY OF FINDINGS

Data collected on the water supply systems fluoridating in the State indicated only five of the fourteen installations selected for investigation evidenced a fluoride content in the distribution system within the 1.0-1.5 mg/l range recommended by the Department of Health. The remaining nine installations were underfeeding, i.e., the fluoride levels in the samples collected from the distribution system were less than 1.0 mg/l. Table II, Analysis of Samples from Selected Fluoridated Water Supply Systems, tabulates the fluoride

KENTUCKY WATER SUPPLY PROGRAM EVALUATION

TABLE II
ANALYSIS OF SAMPLES FROM SELECTED FLUORIDATED WATER SUPPLY SYSTEMS

(Fluoride, mg/l)

Water Supply System	Date of Sample	Raw Water	Check Samples (Operator)	Check Samples (EPA)	Distribution System	
West District						
Benton	8/19	0.12	1.2	1.4	1.4	1.4
Elkton	8/19	0.10	1.0	1.9	0.97	0.90
Owensboro	8/18	0.20	1.0	0.79	0.83	0.80
North Central District						
Kenton Co. W.D.#1	8/23	0.20	1.08	0.78	0.65	0.67
Louisville	8/17	0.26	1.05	0.78	0.80	0.63
Midway	8/17	0.24	1.0	0.94	1.05	0.94
South Central District						
Bowling Green	8/20	0.11	0.2	0.29	0.29	0.35
Greensburg	8/20	0.09	1.2	1.05	1.12	1.10
Somerset	8/25	0.11	1.2	1.05	1.15	1.20
Northeast District						
Grayson	8/27	0.05	1.2	1.2	1.45	1.55
Lexington	8/24				0.81	1.07
Richmond Rd.		0.16	1.0	0.59		
Kentucky R.		0.09	1.23	0.79		
West Liberty 1/	8/27	0.06		0.05		
Southeast District						
Campton	8/26	0.12		0.10	0.10	0.11
Corbin	8/25	0.22	1.2	0.78	0.86	0.90
Jenkins	8/26	0.17	0.92	0.69	0.83	0.85

1/ Fluoridation discontinued approximately August 10, 1971 - Feeder repairs required analysis results of the water samples collected at each facility surveyed.[2]

Operating conditions observed at the installations inspected during the time of the survey are summarized as follows:

I. Analytical Control of the Fluoride Level

Practices to analytically test and control the fluoride level in the water system varied considerably at each installation. Only six (43 percent) of the plant operators or chemists reported fluoride analysis within ±0.1 mg/l of the sample results analyzed by the Water Supply Programs Division, EPA. Daily finished water fluoride analysis was being conducted at ten (71 percent) of the facilities, and regular raw water fluoride analysis was being conducted at six (43 percent). Not one plant operator or chemist was collecting daily samples of raw water, plant effluent and samples from the distribution system for fluoride analysis as required by the Department of Health Fluoridation Regulations. Adequate laboratory equipment and facilities for fluoride analysis by one of the three Standard Methods was available at ten (71 percent) of the facilities surveyed and care for laboratory equipment was found satisfactory at nine (64 percent) of the water treatment plants. One of the water plant chemists interviewed was not using a current Standard Method for fluoride analysis even though he had suitable equipment and facilities because he favored an older method. Records of the fluoridation operation were accepted at nine (64 percent) of the installations studied.

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[2] Fluoride samples were analyzed using the Electrode Method by the Water Supply Programs Division, Environmental Protection Agency, Washington, D. C.

II. Fluoride Feed Equipment and Facilities

Fluoride feed equipment and facilities were found deficient in seven (50 percent) of the installations surveyed and only two (14 percent) of the feeding arrangements were rated acceptable, i.e., protected against overfeeding, preferred point of feed application and good housekeeping in the feeder area. Three (21 percent) of the operators reported one or more interruptions in fluoridation of one or more days duration in the past twelve months. Maintenance was found satisfactory at only seven (30 percent) of the facilities surveyed even though the plant operators had been alerted to the inspection visit.

III. Fluoride Compound - Storage and Handling

Storage arrangements for the fluoride chemicals fed were found unsatisfactory at seven (50 percent) of the installations rated and only five (36 percent) had locked, separate storage facilities for the fluoride chemicals used as required by the Department of Health Fluoridation Regulations. Seven (50 percent) of the operators interviewed did not have available or were not using safety equipment in handling the fluoride compounds; and eight (57 percent) of the operators were permitting unsafe reuse of the chemical shipping containers or were not disposing of the empty containers in a satisfactory manner.

IV. Operator Training and Interest

A trained operator with a genuine interest in feeding fluorides is essential to the satisfactory operation of a fluoride installation. Five (36 percent) of the installations rated were operated by personnel not completely familiar with the fluoride feed equipment at his plant or were new employees and had not been trained to operate the equipment. Three (21 percent) of the operators interviewed were not adequately trained in the use of the fluoride test equipment available and the procedures to follow in conducting a fluoride analysis. Two (14 percent) of the fourteen water plants rated did not have a licensed operator in charge and five (36 percent) of the operators questioned did not favor feeding fluorides to public water supply systems.

V. Surveillance

Frequent check samples of fluoride levels in the distribution system and regular inspection visits to the water fluoridation installation by State Water Supply Program personnel must be conducted to assure the facility is operating satisfactorily. Semi-monthly check samples for fluoride analysis by the State Laboratory are required from each water supply fluoridation system. The Division of Sanitary Engineering records show 2079 water samples were analyzed for fluoride last year; however, a total of 2616 (24 x 109) analyses would be required if all the fluoridated installations submitted semi-monthly samples. Either no samples at all were received from twenty-four of the

109 water supply systems fluoridating, and only eighty-six supplies were fluoridating and submitted the required number of samples, or semi-monthly samples were not submitted by the operators of all the fluoridated supplies. A minimum of at least one sample per month was being sent to the State Laboratory for fluoride analysis by the fourteen water plant operators interviewed. Only five (36 percent) of the installations surveyed had been visited in the past twelve months by a representative of the State Health Department's Division of Sanitary Engineering. Inspection visits to the water supply systems surveyed averaged one visit in twenty-eight months.

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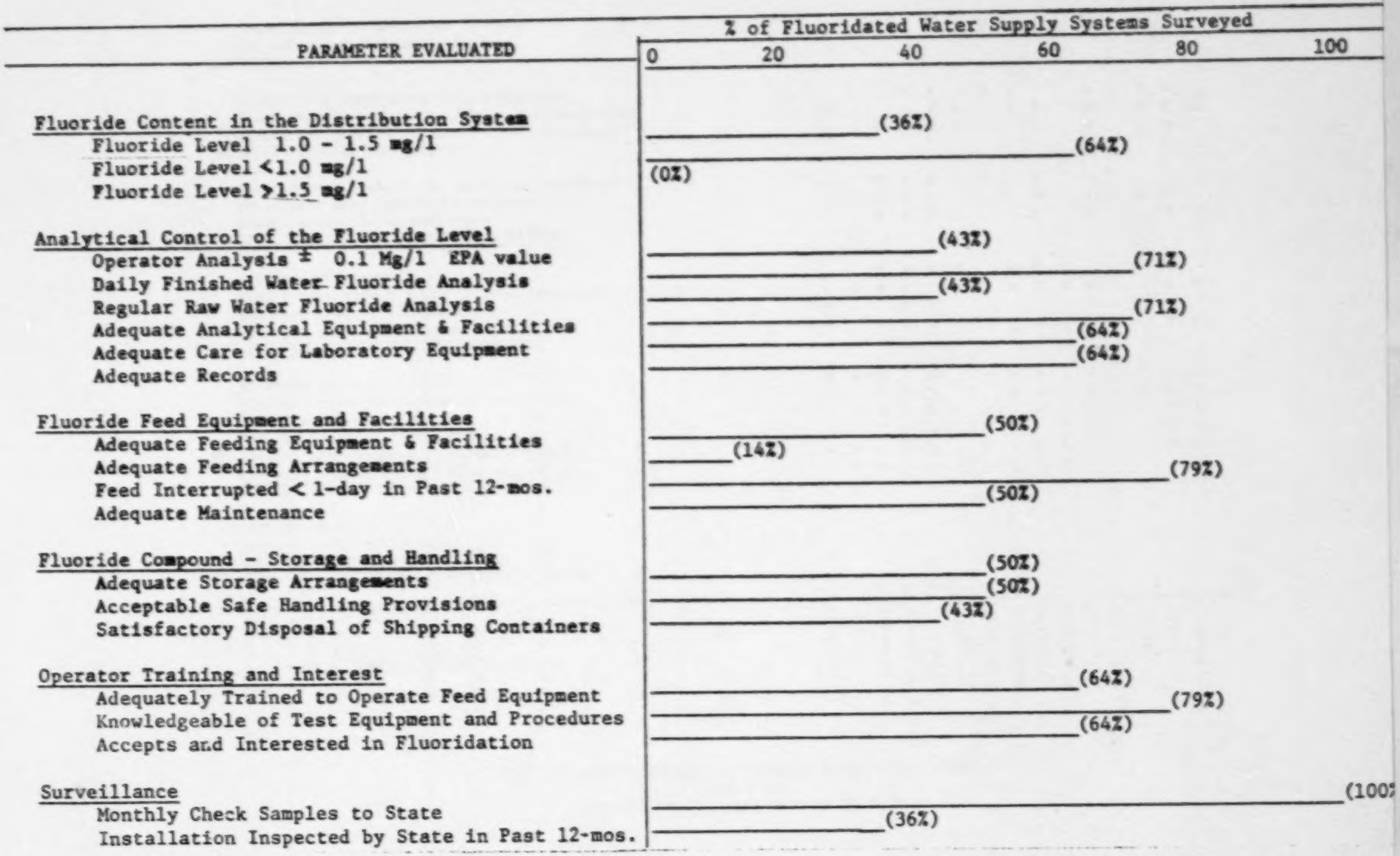
Figure 2, Operating Conditions at Selected Fluoridated Water Supply Systems, summarizes the operating conditions observed at the installations inspected during the time of the survey. Conditions varied at each facility and Table III, Adequacy of Fluoridation at Selected Water Supply Systems, summarizes the adequacy of the operating conditions at each facility rated.

CONCLUSIONS AND RECOMMENDATIONS

1. One hundred nine (109) public water supply systems in Kentucky of a reported 423 public supply systems in the State were fluoridating June 1, 1971. Four supplies are known to have one or more sources of natural fluorides within the 1.0-1.5 mg/1 range recommended by the State Department of Health. Therefore, only 26 percent of the public water supply systems in Kentucky are

KENTUCKY WATER SUPPLY PROGRAM EVALUATION
FIGURE 2
OPERATING CONDITIONS AT SELECTED FLUORIDATED WATER SUPPLY SYSTEMS 1/



1/ Fourteen installations were rated. One of the fifteen water supply systems selected for the survey was not fluoridating at the time of the field visit.

KENTUCKY WATER SUPPLY PROGRAM DIVISION
TABLE III
ADEQUACY OF FLUORIDATION AT SELECTED WATER SUPPLY SYSTEMS

PARAMETER EVALUATED	Benton	Elkton	Owensboro	Kenton Co.W.D.#1	Louisville	Midway	Bowling Green	Greensburg	Somerset	Grayson 1/	Lexington	West Liberty 2/	Campton	Corbin	Jenkins
Fluoride Content in the Distribution System															
Fluoride content 1.0 - 1.5 mg/l	x					x		x	x	x					
Fluoride level < 1.0 mg/l		x	x	x	x		x				x		x	x	x
Fluoride level > 1.5 mg/l															
Analytical Control of the Fluoride Level															
Operator analysis ± 0.1 mg/l EPA value		x				x	x	x	x	x					
Daily finished water fluoride analysis	x	x		x	x		x		x	x	x			x	x
Regular rawwater fluoride analysis				x	x		x				x			x	x
Adequate analytical equipment & facilities		x	x	x	x		x		x		x		x	x	x
Adequate care for laboratory equipment	x			x	x			x	x		x		x	x	x
Adequate records	x	x	x		x			x	x		x			x	x
Fluoride Feed Equipment And Facilities															
Adequate feeding equipment & facilities	x		x	x	x				x					x	x
Adequate feeding arrangements				x	x										
Feed interrupted < 1 day in past 12-months	x	x	x	x		x		x	x	x	x			x	x
Adequate maintenance			x	x	x	x		x	x					x	
Fluoride Compound - Storage and Handling															
Adequate storage arrangements	x		x	x	x				x		x			x	
Acceptable safe handling provisions			x	x	x				x		x		x	x	
Satisfactory disposal of shipping containers	x		x	x	x		x		x						
Operator Training and Interest															
Adequately trained to operate feed equipment	x	x	x	x	x	x			x		x			x	
Knowledgeable of test equipment and procedures	x			x	x	x	x	x	x		x		x	x	x
Accepts and interested in fluoridation		x		x	x		x	x	x		x		x	x	
Surveillance															
Monthly check samples to state	x	x	x	x	x	x	x	x	x	x	x		x	x	x
Installation inspected by state in past 12-months	x				x		x		x		x				

x - Satisfactory or applicable for community surveyed
1/- New treatment plant and fluoridation facilities under construction
2/- Fluoridation discontinued approx. August 10, 1971 - feeder repairs required

supplying or attempting to supply water containing the State recommended concentration of fluorides.

Recommendation:

The Kentucky Department of Health should more actively promote fluoridation in Kentucky particularly in the smaller communities to make the benefits of fluoridated water available to the population served by the more than 300 public water supplies in the State not fluoridated or not containing dentally significant concentrations of natural fluorides.

2. Only five (36 percent) of the fluoridated water supply systems surveyed evidenced a fluoride content in the distribution system within the 1.0-1.5 mg/l range recommended by the State Department of Health. The supplies not containing fluorides in the distribution system within the recommended range were underfeeding. Only six (43 percent) of the operators rated reported fluoride analysis within ±0.1 mg/l of the fluoride value determined by the Water Supply Programs Division, EPA on a duplicate sample. Not one plant operator or chemist at the facilities surveyed was collecting daily samples of raw water, plant effluent and samples from the distribution system for fluoride analysis as required by the Department of Health Fluoridation Regulations.

Recommendation:

The Kentucky Department of Health should provide the necessary training and technical assistance to the water plant operators at fluoridation installations to control the fluoride ion level in the distribution system within the recommended range. Enforcement of the State Health Department fluoride sampling regulations, adequate laboratory equipment and care of equipment, and complete records on the fluoridation operation should be required at all fluoridation installations.

3. Fluoride feed equipment and facilities to control the distribution system fluoride level to within the recommended range were satisfactory at seven (50 percent) of the installations rated and feeding arrangements were judged adequate at only two (14 percent) of the plants surveyed. Three (21 percent) of the installations reported one or more interruptions in fluoridation of one or more days duration in the past twelve months and maintenance conditions were less than satisfactory in seven (50 percent) of the facilities rated even though each operator had been alerted to the visit.

Recommendation:

The Kentucky Department of Health should provide design assistance to all communities proposing to install fluoridation facilities, thoroughly review all proposed installations before the operation is approved, and assist the operator as needed during the "start-up" period. Repeated inspection visits to a new installation should be conducted during the first year of operation to assure satisfactory operation of the facility. A preventive maintenance program should be established for each facility and closely followed for the installation to receive continued approval for operation.

4. Storage arrangements and safety precautions for handling fluoride compounds were judged inadequate at seven (50 percent) of the facilities surveyed. Only five installations (36 percent) had locked, separate storage facilities for fluoride chemicals used as required by the Department of Health Fluoridation Regulations.

   Recommendation:

   The Kentucky Department of Health should instruct all water plant operators feeding fluorides on safe handling and storage practices for fluoride compounds and enforce their regulations on handling and storage of fluoride compounds.

5. A trained operator with a genuine interest in feeding fluorides is essential to the satisfactory operation of a fluoridation installation. Training deficiencies were noted in the operators' knowledge of his fluoride feed equipment and his acquaintance with the test equipment and procedures used in conducting fluoride analysis. Five (36 percent) of the operators interviewed did not favor feeding fluorides to public water supply systems.

   Recommendation:

   The Kentucky Department of Health should expand their water and sewage operators' school to include a training course in fluoride feed equipment operation and fluoride determinations in water for all operators of fluoridated water supply systems. The benefits of water fluoridation and the importance of maintaining the fluoride level within the recommended range should be stressed. Satisfactory completion of the course should be a mandatory requirement of the plant operator for approval of his installation to feed fluorides.

6. Surveillance of each water fluoridation installation must be on a regular, continual basis to assure the facility is operating satisfactorily. Inspection visits to the installations surveyed averaged one visit in twenty-eight months.

   Recommendation:

   The Kentucky Department of Health should conduct a minimum of two field inspections per year to the water fluoridation installations in the State and visit immediately all plants employing new operating personnel placed in charge of the fluoridation operation. Two full-time engineers with the necessary travel funds and laboratory support are estimated to be needed for an adequate fluoridation control program in Kentucky.

DATE: ____________

KENTUCKY FLUORIDATION SURVEY

Water System:

Population Served: Average Flow:

Date Fluoridation Started:

Source of Supply:

Treatment:

Fluoride Analysis:
Raw Water: Finished Water:

Fluoridation Equipment -

Manufacturer:

Type:

Model:

Location:

Point of application:

Condition of equipment:

Operational problems:

Overfeeding safeguards:

Planned Improvements:

Remarks:

Fluoride Compound -

Chemical: Cost:

Source:

Form of shipment

Storage facilities:

Quantity used:

Safety provisions:

Remarks:

Control of Fluoridation -

Frequency of sampling:
Raw water: Finished water:

Sampling point:

Test method:

Test instrument:

Records:

Interruptions:

Remarks:

Operator Qualifications -

Experience: Classification:

Training:

Interest:

Remarks:

Surveillance -

Check samples:

Last visit by State:

Availability of technical assistance:

Remarks:

Comments -

APPENDIX E

CHAPTER 211

DEPARTMENT OF HEALTH; MEDICAL AND DENTAL SCHOLARSHIPS

DEPARTMENT OF HEALTH

211.005 Declaration of legislative policy concerning public health laws
211.015 Definitions for KRS 211.005 to 211.330
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211.030 Commissioner of Health; selection; term; qualifications
211.035 Deputy commissioners; acting commissioner
211.040 State Board of Health; members; qualifications; how selected
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211.270 Payment of travel expense of personnel
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211.540 Expenses of citizen members; advisory committees
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211.610 Definition for KRS 211.610 to 211.650
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PENALTIES

211.990 Penalties

CROSS REFERENCES

Alcoholism, KRS Ch. 222
Communicable diseases, KRS Ch. 214
Foods, drugs and poisons, KRS Ch. 217 and 218
Frozen food locker plants, KRS Ch. 221
Hospitals and clinics, KRS Ch. 215 and 216
Hotel, restaurants and trailer parks, KRS Ch. 219
Local health units, KRS Ch. 212
Mental health department, KRS Ch. 210
Medical practice, KRS Ch. 311
Nurses, KRS Ch. 212 and 314
Occupations and professions, KRS Title XXVI
Pharmacists, KRS Ch. 315
Physicians, KRS Ch. 311
Sanitation districts, KRS Ch. 220
Vital Statistics, KRS Ch. 213
Water pollution, KRS Ch. 220
Welfare, KRS Title XVII

DEPARTMENT OF HEALTH

211.005 Declaration of legislative policy concerning public health laws. The General Assembly of the Commonwealth of Kentucky recognizes and hereby declares that it is an essential function, duty and responsibility of the government of this Commonwealth to adequately safeguard the health of all its citizens, and to establish, maintain, implement, promote and conduct appropriate facilities and services for the purpose of protecting the public health. This chapter is enacted with the expressed legislative intention of effectuating the aforesaid objectives in the manner provided herein. (1954, c. 157, § 1)

211.010 [4618–21; 4618–108; 4618–109] **Department of Health; functions. (Repealed, 1954, c. 157, § 2)**

211.015 Definitions for KRS 211.005 to 211.330. As used in KRS 211.005 to 211.330, unless the context requires otherwise:

(1) "Department" means the State Department of Health;

(2) "Board" means the State Board of Health;

(3) "Commissioner" means the Commissioner of Health;

(4) "Deputy" means Deputy Commissioner of Health;

(5) "Division" means a division of the Department of Health;

(6) "President" means President of the State Board of Health;

(7) "Secretary" means Secretary of the State Board of Health. (1954, c. 157, § 2)

211.020 [2054; 4618–22; 4618–23; 4618–108; 4618–109] **Agencies included in the Department of Health; branch offices.** (1) There is in the state government a Department of Health. The department shall consist of the board, the commissioner and deputy commissioners, and the divisions set out in KRS 211.100 and such divisions as may be created pursuant to KRS 12.030. Also included in the department, for administrative and budgetary purposes, are the State Water Pollution Control Commission as provided for in KRS 220.600, the Hospital Council established by KRS 216.460, the State Hospital Advisory Council, and such other councils as may be appointed by the Governor or the board.

(2) The department may, with the written approval of the Governor, establish branch offices in the state. (1954, c. 157, § 3; effective June 17, 1954)

Health and Welfare Agency, department is part of, KRS 12.022

211.025 General powers and duties of department. Except as otherwise provided by law, the department shall administer all provisions of law relating to public health; shall enforce all public health laws and all regulations of the board; shall supervise and assist all local boards of health and departments; shall do all other things reasonably necessary to protect and improve the health of the people; and may cooperate with federal and other health agencies and organizations in matters relating to public health. (1954, c. 157, § 4)

Alcoholism, study and treatment of, KRS 222.035
Blood test of pregnant women, duties of Department of Health as to, KRS 214.160, 214.170
Department of Mental Health, cooperation with Department of Health, KRS 210.040
General powers of statutory departments, Ch. 12
Malt beverages, bottling of to be conducted in accordance with rules of Department of Health, KRS 243.190, 244.550
Sanitation Districts and Water Pollution Control, Ch. 220
School teachers, free physical examinations for, KRS 161.156

211.030 [2047; 2052; 2054; 4618–23; 4618–152] **Commissioner of Health; selection; term; qualifications.** The commissioner shall be the chief executive officer of the department. Beginning with the term commencing on July 1, 1954, he shall be elected by a majority of the appointed members of the board to serve for a term of four years and until his successor is elected and qualified. The board may elect one of its own members as commissioners. The commissioner shall be a graduate of a school of medicine approved by the board, shall be licensed to practice medicine in this state, and shall have had at least five years' experience in public health administration. (1946, c. 27, § 32; 1954, c. 157, § 5)

Appointive powers of commissioner, KRS 12.040
Bond of Commissioner, amount and conditions, KRS 62.160, 62.180
Flood Control and Water Usage Board, Commissioner of Health is adviser to, KRS 104.390
Nursing Home and Personal Care Home Loan Fund Board, Commissioner of Health is a member of, KRS 216.770

211.035 Deputy commissioners; acting commissioner. The commissioner may appoint not more than four deputy commissioners and delegate to them such of his powers, duties and authority as will facilitate and expedite the operations of the department. Not all of said deputy commissioners need be graduates of medical schools or licensed to practice medicine. The commissioner may designate one of said deputy commissioners as acting commissioner to exercise and perform all of the functions, duties and authority of the commissioner during his absence. (1954, c. 157, § 6; effective June 17, 1954)

211.040 [2047; 2613-2; 4618-24] **State Board of Health; members; qualifications; how selected.** There shall be a State Board of Health, consisting of ten members, each of whom must be licensed in this state to practice the profession required of him by this section as a qualification for membership. The board shall be a continuation of the board appointed under Chapter 120 of the Acts of 1920. Nine of the members shall be appointed by the Governor, by and with the advice of the Senate. The Commissioner of Health shall constitute the tenth member. One member of the board shall be a registered pharmacist, and shall be appointed from a list of three names submitted by the Kentucky Pharmaceutical Association. One member shall be a licensed dentist and shall be appointed from a list of three names submitted by the Kentucky Dental Association. One member shall be a licensed osteopath and shall be appointed from a list of three names submitted by the Kentucky Osteopathic Association. All other members shall be licensed medical physicians and shall be appointed from a list of three names submitted for each position by the Kentucky State Medical Association. If the board elects one of its members as Commissioner of Health, the Governor shall appoint another member to complete the full number of the board. No member of the board, except the Commissioner of Health, shall be a stockholder or member of the faculty or board of trustees of any medical or dental college. (1950, c. 111; 1960, c. 7; effective June 16, 1960)

Appointments to boards and commissions, KRS 12.070, 61.070
Governor may reject lists of names submitted, KRS 12.070

211.050 [2048; 4618-24] **Terms of board members; vacancies.** The members of the State Board of Health shall hold office for terms of four years and until their successors are appointed and qualify. In the appointment of successors and the filling of vacancies the classification of membership provided for in KRS 211.040 shall be observed. Any vacancy in the board occurring before the expiration of a term shall be filled by the Governor for the unexpired term subject to confirmation by the Senate, except that the member appointed to fill the first vacancy occurring for a term expiring on January 1, 1954 and a member appointed to fill a vacancy occurring for the term expiring on September 7, 1952 shall be appointed to terms expiring on December 31, 1952. The terms of all present and future members of the board shall expire on December 31 of the fourth year of their respective terms. (1948, c. 222, § 3; 1950, c. 203)

211.060 [2047; 2050] **Meetings; quorum; president; rules; oaths.** The State Board of Health shall hold meetings at least semiannually, and more frequently and at such places and times as the board may determine. A majority of the members shall constitute a quorum. The board shall elect a president from among its members, and may adopt rules and bylaws for its government. Any and all members of the board may administer oaths in matters pertaining to official duties of the board. (1952, c. 153, § 1; effective June 19, 1952)

Oath taken by members, Const. 228

211.070 [2051; 2053; 2613-1] **Compensation of members of board.** (1) The president of the State Board of Health shall receive an annual salary to be fixed by the board.

(2) Each member of the State Board of Health, other than the president, shall receive twenty dollars per day for each day in attendance at meetings of the board.

(3) Each member of the board, including the president, shall be entitled to reimbursement for all expenses for travel, lodging and subsistence incurred in connection with attendance at meetings of the board.

(4) The board may designate any of its members, representatives or agents to perform special duties that may be prescribed by the board from time to time, and may allow reasonable compensation therefor and make reimbursement for expense for necessary travel, lodging and subsistence

incurred in connection therewith. (1952, c. 153, § 2; effective June 19, 1952)

Employment and compensation of employes of statutory administrative departments, KRS 12.050, 12.060

211.080 [2047; 2052] Powers and duties of Commissioner of Health. (1) The Commissioner of Health shall be secretary of the State Board of Health. He shall:

(a) Keep his office at some centrally located place in the state, designated by the board.

(b) Keep a record of the transactions of the board, and have custody of all books, papers, documents and property belonging to the board that may be deposited in his office.

(c) Communicate, so far as practicable, with other state boards of health and with the local boards within this state, and keep on file all reports received from such boards and all correspondence of the office appertaining to the business of the board.

(d) Prepare necessary blank forms of returns and instructions and forward them to the local boards of health.

(e) Collect information concerning vital statistics, knowledge with respect to diseases, and all useful information on the subject of hygiene, and through an annual report, and otherwise as the board may direct, disseminate such information among the people.

(f) Supply local boards of health, on demand, with reliable vaccine virus for the gratuitous vaccination of the poor.

(g) So far as possible, aid in obtaining contributions to the library of the board.

(h) Perform the duties prescribed by law or required by the board.

(2) The commissioner may administer oaths about matters pertaining to his official duties.

Commissioner is ex officio member of State Tuberculosis Hospital Commission, KRS 215.006
Commissioner to serve as chairman of Hospital Council, KRS 216.460
Premarital examination, duties of Commissioner of Health as to, KRS 402.120 to 402.200

211.090 [2049; 2050; 2054; 2062a-1] Powers and duties of State Board of Health; transfer of certain powers to department. (1) The board shall:

(a) Appoint county boards of health pursuant to KRS 212.020;

(b) Hear and decide appeals from rulings, decisions and actions of the department or the commissioner, where the aggrieved party makes written request therefor to the board within thirty days after the ruling, decision or action complained of;

(c) Elect the commissioner in the manner prescribed in KRS 211.030;

(d) Adopt rules and regulations necessary to regulate and control all matters set forth in KRS 211.180 to the extent the regulation and control of same have not been delegated to some other agency of the Commonwealth and adopt such other rules and regulations as may be necessary to effectuate the purposes of this chapter and any other law relating to public health, except as otherwise provided by law;

(e) Issue or deny hospital licenses pursuant to KRS 216.400 to 216.500;

(f) Approve or disapprove the establishment of proposed hospital service corporations and contracts for hospital service corporations and contracts for hospital services pursuant to KRS 303.020 to 303.040;

(g) Approve or disapprove of the establishment of proposed medical service plan corporations and contracts for medical services pursuant to KRS 303.160 to 303.200;

(h) Act in a general advisory capacity to the commissioner on all matters relating to the department;

(i) Enforce and administer the provisions of KRS 311.250, 311.260, 311.375, 311.376, 311.550 to 311.620.

(2) Except as otherwise provided in subsection (1) of this section, all powers and authority of the board under existing statutes, are transferred to the department. (1954, c. 157, § 7; effective June 17, 1954)

Administrative regulations not effective until thirty days after filing with Legislative Research Commission, KRS 13.085
Annual report from Louisville and Jefferson County board of health, KRS 212.570
Attorneys to represent State Board of Health, KRS 212.270
Audit of books of Louisville and Jefferson County board of health, KRS 212.550
Compensation of county health officer, participation in fixing of, KRS 212.190
Labor, Department of to cooperate with State Board of Health, KRS 336.090
Medical service plan corporation, approval of articles and contracts by State Board of Health, KRS 303.160, 303.200
Podiatry, Official Examiners in, appointment, KRS 311.410
Powers and duties of State Board of Health as to:
  Births and Deaths, Ch. 213
  Communicable Diseases, Ch. 214
  Foods and Drugs, Ch. 217

Hospitals and other institutions for care of sick, KRS 216.400 to 216.510
Hospitals, licensing and regulation of, KRS 216.400 to 216.510
Hospital service corporations, KRS 303.020 to 303.050
Immunization of children, KRS 214.034
Local health boards, Ch. 212
Plumbers and Plumbing, Ch. 318
Practitioners of Medicine Generally and Optometrists, Ch. 311
Premartial examinations, KRS 402.120 to 402.200
Tuberculosis, Ch. 215
Visiting nurses, Ch. 212

211.100 [2054] **Divisions of Department of Health.** The Department shall be divided into the following divisions: Division of Budgets and Accounts, Division of Building and Common Services, Division of Preventive Medicine, Division of Dental Health, Division of Food and Drug Control, Division of Hospital Services, Division of Legal Services, Division of Local Health Services, Division of Maternal and Child Health, Division of Medical Care, Division of Medical Licensure, Division of Nutrition, Division of Occupational Health, Division of Personnel and Training, Division of Public Health Education, Division of Public Health Engineering, Division of Public Health Laboratories, Division of Public Health Nursing, Division of Public Health Sanitation, Division of Statistical Services, Division of Tuberculosis Control and Division of Vital Statistics. (1954, c. 157, § 8; 1966, c. 255, § 205)

Births and Deaths, Ch. 213
Children, provisions relating to care of, Chs. 199, 200
Communicable Diseases, Ch. 214
Division of Sanitary Engineering, director made commissioner of sanitary districts and may establish such districts, KRS 220.020
Divisions of statutory administrative departments may be abolished, created, divided or combined, KRS 12.030
Foods and drugs, Ch. 217
Hospitals and Clinics, Ch. 216
Hotel and Restaurant Inspection, Ch. 219
Housing Projects, Ch. 80
Opthalmia and trachoma, prevention of, KRS 214.130 to 214.150
Tuberculosis Sanitoria, Ch. 215

211.101 Directors of divisions; grouping or subdivision of divisions. Each division shall be headed by a director, appointed by the commissioner, provided, however, that in the discretion of the commissioner, two or more of said divisions may be headed by the same director. Divisions may be placed under supervision of one or more deputy commissioners, and may be grouped or regrouped for administrative purposes in such manner as may be determined by the commissioner. Divisions may, in the discretion of the commissioner be subdivided into one or more sections or other subordinate units. (1954, c. 157, § 9)

211.102 Functions of divisions. Divisions shall perform such duties as may be assigned by the commissioner and shall cooperate with and assist each other and all local health departments in all matters to the extent directed by the commissioner, who shall supervise, coordinate and control the operaions of all divisions either individually or by and through one or more deputy commissioners. (1954, c. 157, § 10; effective June 17, 1954)

211.105 Division of Medical Hospitals and Related Services. (1948, c. 189, § 1) **Repealed, 1954, c. 157, § 24.**

211.106 Division of Medical Care. There shall be established in the Department of Health a Division of Medical Care which shall be charged with the responsibility of carrying out the duties of the department under any agreement or contract made with the Department of Economic Security for the purposes of KRS 205.510 to 205.610 and 205.991. (1960, c. 68, Art. VII, § 9; effective March 17, 1960)

Medical assistance, KRS 205.510 to 205.610

211.110 [2060a-12] **Laboratory work for State Board of Health by Experiment Station of University of Kentucky. (Repealed, 1954, c. 157, § 24; effective June 17, 1954)**

211.120 [2060a-13] **Director of laboratories; assistants. (Repealed, 1954, c. 157, § 24; effective June 17, 1954)**

211.130 Definitions for KRS 211.130 to 211.160. As used in KRS 211.130 to 211.160, unless the context requires otherwise:

(1) "Department" shall mean the Department of Health;

(2) "Commissioner" shall mean the Commissioner of Health;

(3) "Physically handicapped person" shall mean a person who is severely handi-

capped as a result of cerebral palsy, poliomyelitis, muscular dystrophy, or spina bifida;

(4) "Educable person" shall mean a physically handicapped person, as defined above, who is determined by the department to be capable of receiving and benefiting from the services and facilities provided by KRS 211.130 to 211.160;

(5) "Funds" shall mean all moneys received by the department from all persons, corporations, associations, organizations, and state or federal government agencies, specifically designated to be used for furnishing facilities and services for educable persons; provided, however, that no moneys appropriated to the department by the General Assembly of this Commonwealth shall be considered to have been appropriated for establishing, providing or maintaining services or facilities for educable persons, unless the Act appropriating such moneys expressly so provides. (1952, c. 165, § 1; effective June 19, 1952)

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211.140 Declaration of legislative purpose. The purpose of KRS 211.130 to 211.160 is to provide for the acceptance, custody and use, by the Commonwealth of Kentucky, of funds and properties that may be given, granted, contributed, donated, bequeathed, devised and conveyed for the hospitalization, training, education and care of physically handicapped persons, including grants that may be made for said purposes by the government of the United States of America. (1952, c. 165, § 2; effective June 19, 1952)

211.150 Facilities and services for physically handicapped persons who are educable. To the extent that funds are made available, the department may establish, provide and maintain facilities and services, including hospital-schools and related medical and nursing care, and vocational, academic and recreational training, instruction and education, for physically handicapped persons who are, in the judgment of the department, found to be educable after examination and diagnosis conducted in accordance with procedures prescribed by the department. (1952, c. 165, § 3; effective June 19, 1952)

211.160 Powers of commissioner in providing service to handicapped persons. (1) The commissioner may, from the funds available, employ, by contract or otherwise such medical, clinical, technical and other personnel that he deems necessary to effectuate the purposes of KRS 211.130 to 211.160, and fix and pay their compensation and necessary traveling expenses.

(2) The commissioner may, from the funds available, procure, by purchase or lease or otherwise, such property, equipment, services, facilities and supplies that he deems necessary to effectuate the purposes of KRS 211.130 to 211.160.

(3) The commissioner is authorized to accept, on behalf of the Commonwealth of Kentucky, all gifts, donations, contributions, grants, devises, bequests and conveyances of real and personal property for establishing, providing and maintaining the services and facilities described in KRS 211.150, subject only to the condition that same shall be devoted to and used for said purposes. All funds received by the commissioner shall be deposited in the State Treasury and credited to a trust and agency fund account and expended only for purposes authorized by KRS 211.130 to 211.160.

(4) The commissioner may make and issue all necessary rules and regulations to carry out KRS 211.130 to 211.160; provided, however, that no educable person shall be eligible for any benefits hereunder unless he is, and has been continuously for at least twelve months immediately preceding the date of his application therefor, an actual resident of this state.

(5) The commissioner may delegate to any division of the department, or to any director thereof, any and all of his authority and duties hereunder.

(6) Upon request of the commissioner, approved in writing by the Governor, any department, agency or commission of the Commonwealth shall furnish without cost to the department such services, facilities and assistance as are available and, in the judgment of the commissioner and the Governor, required, to effectuate the purposes of KRS 211.130 to 211.160 or its administration which is hereby vested in the department. (1952, c. 165, § 4; effective June 19, 1952)

211.170 Functions of department relating to local health departments. In relation to local health departments, the department shall, among other things:

(1) Establish policies governing the activities and practices of such departments;

(2) Supervise their financial, personnel, program, administrative and other functions;

(3) Establish standards of operation in accordance with KRS 212.120;

(4) Evaluate the organization and activities of local health departments;

(5) Conduct state and district conferences for local health officers and local health department personnel;

(6) Allocate, modify or cancel allotments of state funds to local health departments pursuant to KRS 212.120; and

(7) Promote the establishment of local health departments. (1954, c. 157, § 11; effective June 17, 1954)

211.180 Functions of department in the regulation of certain public health matters. The department shall enforce the rules and regulations adopted by the board for the regulation and control of the matters set out below and shall formulate, promote, establish and execute policies, plans and programs relating to all matters of public health, including but not limited to the following matters:

(1) Detection, prevention, and control of communicable diseases, chronic and degenerative diseases, dental diseases and abnormalities, occupational diseases and health hazards peculiar to industry, home accidents and health hazards, animal diseases which are transmissible to man, and such other diseases and health hazards as may be controlled;

(2) The control of insects, rodents and other vectors of disease; the proper disposal of garbage, waste and other refuse; the safe installation and operation of plumbing and plumbing fixtures; the safe disposal of human and other excreta; the safe handling of food and food products; the safety of cosmetics; the control of narcotics, barbiturates and other drugs as provided by law; the purification of water for public and semipublic use; the proper construction and operation of public water purification plants and distribution systems, swimming pools and sewage treatment plants, including the issuance of permits to and the supervision of operators thereof; the sanitation of schools, industrial establishments and other public and semipublic buildings; the sanitation of state and county fairs and other similar public gatherings; the sanitation of public and semipublic recreational areas; the sanitation of public rest rooms, trailer courts, hotels, tourist courts, and other establishments furnishing public sleeping accommodations; the review, approval or disapproval of plans for construction, modification or extension of food-handling establishment, water purification and distribution systems, swimming pools, sewage treatment plants and such other establishments, systems, plants and places as are designated by the board; the licensure of hospitals; and the control of such other factors as may be necessary to insure a safe and sanitary environment;

(3) Protection and improvement of the health of expectant mothers, infants, preschool and school age children;

(4) The practice of midwifery, including the issuance of permits to and supervision of women who practice midwifery;

(5) Protection and improvement of the health of the people through better nutrition. (1954, c. 157, § 12; effective June 17, 1954)

211.182 Treatment of cancer restricted to physicians. (1) For the purposes of this section, "cancer" means all malignant neoplasms regardless of the tissue of origin, including malignant lymphoma and leukemia.

(2) No person, other than a licensed medical or osteopathic physician, or dentist, shall in any manner hold himself out to any other person as being able to prescribe treatment for, or cure the disease of cancer.

(3) No person, other than a licensed medical or osteopathic physician, or dentist, shall in any manner undertake to treat, or prescribe for the treatment of the disease of cancer.

(4) No person shall sell or offer to sell, or give away or offer to give away, except upon the prescription of a licensed medical or osteopathic physician, or dentist, any drug, medicine, compound, nostrum or device which is represented by the manufacturer or seller thereof to have curative powers when used in the treatment of the disease of cancer.

(5) Nothing contained herein shall be construed to impose any limitation upon the free exercise of religion in this state. (1960, c. 47, § § 1, 2, 3, 4, 6; effective June 16, 1960)

Physician, dentist, defined, KRS 218.010, 64.655

211.184 Enforcement of KRS 211.182 by department and board. (1) It shall be the duty of the department to enforce the provisions of KRS 211.182, and for that purpose the investigators, inspectors, representatives and agents of the board and the department shall have the full power and authority of peace officers in this state, and shall have the power and authority to administer oaths, to enter upon premises at all times for the purpose of making inspections, to seize evidence, to interrogate all persons, and to require the production of books, papers, documents or other evidence.

(2) The board may institute, in its own name, proceedings to enjoin and restrain violations of KRS 211.182, regardless of whether the defendant has been convicted of violation of the penal provisions thereof, and shall not be required to pay any costs or filing fees or furnish any bond in connection therewith. Violation of injunctions and restraining orders shall be punished as a contempt without the intervention of a jury, and the court's discretion concerning the degree of punishment shall not be subject to the provisions of KRS 432.260. (1960, c. 47, § 5; effective June 16, 1960)

Peace officer, defined, KRS 61.310, 446.010

211.190 Public health services to be provided by the department. The department shall provide public health services including the following:

(1) Administrative, consultative, technical, professional and other services needed to assist local health departments in the effective maintenance and operation of their departments;

(2) Administrative, investigative and clerical services required by the board and may upon request provide such services to any other agency of this Commonwealth authorized to control the practice of any other healing art;

(3) Administration of grants, gifts or contributions from the federal government, or from other sources, for the purpose of carrying out the provisions of Public Law No. 725 (79th Congress, 2nd Session, Chapter 958) or any other Acts for the same or similar purposes;

(4) Central registrations of births, deaths and other vital records and the furnishing of copies thereof to the general public in the manner prescribed by law;

(5) Statistical services, including the compilation, analysis and maintenance of statistics on matters related to public health, and may provide such services to organizations and persons interested in public health;

(6) Education of the public concerning all matters relating to health, including the publication and dissemination of health information, and the stimulation of citizen support for the promotion and maintenance of high standards of public health throughout the Commonwealth;

(7) Survey and study of the needs of medical and hospital facilities in the interest of the health of the general public;

(8) Establishment, maintenance and operation of public health laboratories and such branches thereof as may be needed;

(9) Establishment, maintenance and operation of training facilities and schools for employes of the department and of local health departments;

(10) Tabulating, duplicating and such other ancillary services as are necessary to the operation of the department, including the keeping of adequate financial, personnel and other records. (1954, c. 157, § 13; effective June 17, 1954)

211.200 Assignment of department personnel to a county in case of public health emergency or when county lacks adequate local health department. Whenever, in the opinion of the commissioner, a public health emergency exists in any county, or whenever any county fails to establish, maintain and operate a local health department therein meeting the standards prescribed by the department, the department may assign to said county such of its own personnel as may be designated by the commissioner. Such personnel so assigned shall have the full power and authority of local health department employes in addition to their power and authority as representatives of the department. Whenever such assignment results by reason of the lack of a local health department or of a local health department meeting the standards prescribed by the department, any funds appropriated or allocated to the local health department by either the Commonwealth or the Federal government may be used to reimburse the department. (1954, c. 157, § 14; effective June 17, 1954)

211.210 Abatement of nuisances. The department may examine into all nuisances, sources of filth and causes of sickness

that may, in its opinion be injurious to the health of the inhabitants in any county in this state, or in any vessel within any harbor or port in any county in this state. Whenever any such nuisance, source of filth or cause of sickness is found to exist on any private property, or in any vessel within any port or harbor in any county in this state, or upon any watercourse in this state, the department may order, in writing, the owner or occupant thereof, at his own expense, to remove the same within twenty-four hours, or within such reasonable time thereafter, as the department may order. (1954, c. 157, § 15; effective June 17, 1954)

211.220 Powers of department personnel in the conduct of investigations; subpoenas, process. For the purposes of enforcing the public health laws of the Commonwealth, investigators, inspectors, officers, representatives and agents of the department may enter upon any premises when necessary for the purpose of making inspections and investigations, and may view evidence and interrogate persons, to the extent required in the performance of their duties and responsibilities. The board or the commissioner may issue subpoenas, subpoenas duces tecum and all necessary process in proceedings brought before or initiated by the department or board, and such process shall extend to all parts of the Commonwealth. Service of process may be made by registered mail or in the manner prescribed by the Rules of Civil Procedure. Nothing in this section shall be construed to authorize the department or board to regulate the practice of any healing art where the licensure regulation and control of same has been conferred by statute upon some other agency of the state. (1954, c. 157, § 16; effective June 17, 1954)

211.230 Enforcement of obedience to orders and process; coercion of witness to testify. In case of a failure on the part of any person, firm or corporation to comply with any lawful order of the board, or with process, or in case of the refusal of any witness to testify concerning any matter on which he may be lawfully interrogated, the circuit court, or a judge thereof, having jurisdiction may, on application of the board or the commissioner, compel obedience by proceedings as in contempt cases. (1954, c. 157, § 17; effective June 17, 1954)

211.240 Duties of Attorney General, county, city and Commonwealth's attorneys. County, city and Commonwealth's attorneys, and the Attorney General, shall, within their respective jurisdictions, prosecute all violations of the penal provisions of the public health laws of this Commonwealth. (1954, c. 157, § 18; effective June 17, 1954)

211.250 Political activity by personnel prohibited. While retaining the right to vote as he may please and to express privately his opinion of all political subjects and issues, no employe or officer of the department, including the commissioner, shall take any active part in political management or political campaigns, nor shall he use his office or influence for the purpose of interfering in any election or affecting the results thereof, or for the purpose of coercing the political action of any body or person. (1954, c. 157, § 19; effective June 17, 1954)

211.260 Appeals from action by commissioner. Any person who is aggrieved by any ruling, decision or action of the commissioner on other than matters of internal administration may appeal to the board within thirty days after said ruling, decision or action, by filing with the board a written complaint setting out the ruling, decision or action complained of, the reasons that such person is aggrieved and the relief sought by such person. (1954, c. 157, § 20; effective June 17, 1954)

211.270 Payment of travel expense of personnel. All officers, assistants and employes of the department shall be paid their necessary traveling expenses while engaged in the discharge of their official and departmental duties. (1954, c. 157, § 21; effective June 17, 1954)

211.280 Powers of department concerning gifts, grants and endowments. (1) The department may receive and accept gifts and endowments of every kind including gifts and endowments for special purposes and may receive grants from the federal government. Moneys acquired through gifts, endowments or grants shall be deposited in the State Treasury to the credit of a trust or agency fund to be used for the purposes for which they are received. Gifts or endowments with special restrictions as to use or purpose shall be expended in accordance with such restrictions.

(2) The department may mortgage, pledge, sell or convey lands or goods so received unless specifically prohibited by the terms of the gift, proceeds therefrom to go to the credit of a trust or agency fund set out in subsection (1) of this section. (1954, c. 157, § 22; effective June 17, 1954)

MEDICAL SCHOLARSHIPS

211.290 Rural Kentucky Medical Scholarship Fund. The Kentucky State Department of Health shall aid, assist and promote the Rural Kentucky Medical Scholarship Fund with such sums as may, from time to time, be appropriated by the General Assembly for this purpose. (1954, c. 181, § 1; effective June 17, 1954)

211.300 Declaration of legislative policy and definition for KRS 211.300 to 211.330. (1) In enacting legislation relating to loans and scholarships for the study of medicine, it is the intention of the General Assembly to alleviate the shortage of physicians engaged in public health work.

(2) As used in KRS 211.300 to 211.330, unless the context requires otherwise, "Board" means the State Board of Health. (1954, c. 136, §§ 1, 2; effective June 17, 1954)

211.305 Applications for medical education loans and scholarships. The board shall receive and consider all applications for loans or scholarships made by students who are bona fide residents of this Commonwealth who desire to become physicians and who are acceptable for enrollment in a medical school approved by the board. The board shall make a careful and full investigation of the ability, character and qualifications of each applicant to determine his fitness to become the recipient of such loan or scholarship. The board may examine each applicant. It may prescribe such rules and regulations as it deems necessary and proper to carry out the purpose and intent of KRS 211.300 to 211.330. The board may grant to each applicant deemed by the board to be qualified to receive the same, a loan or scholarship as herein provided for the purpose of acquiring a medical education upon terms and conditions imposed by the board and provided for in KRS 211.300 to 211.330. (1954, c. 136, § 3; effective June 17, 1954)

211.310 Maximum amount and conditions of loan or scholarship. A loan or scholarship shall not exceed one thousand dollars per annum, to defray tuition and other expenses in a medical college or school approved by the board. The grant shall be based upon the condition that on or before six months from the date the applicant completes one year of internship he engage in public health work at some place within the Commonwealth approved by the board at the rate of one year for each one thousand dollars, or proportional time for lesser amounts, which shall constitute repayment of the loan or scholarship. Where the board is convinced that there is justifiable cause which the applicant could not have foreseen, the board may allow him to repay the loan or scholarship by paying in cash the full amount of the loan or scholarship plus six percent interest. (1954, c. 136, § 4; effective June 17, 1954)

211.315 Execution of contract for loan or scholarship. Before being granted a loan or scholarship each applicant shall enter into a contract with the board which shall be deemed a contract with the Commonwealth of Kentucky, agreeing to the terms and conditions upon which the loan or scholarship shall be granted to him. The contract shall include such terms and provisions as will carry out the purpose and intent of KRS 211.300 to 211.330 and shall be signed by the president of the board, countersigned by the secretary, and signed by the applicant. (1954, c. 136, § 5; effective June 17, 1954)

211.320 Cancellation of contract; repayment of loan or scholarship. The board may cancel any contract between it and any applicant for a loan or scholarship upon any cause deemed sufficient by the board in which event the student shall repay with six percent interest the amount of the loan or scholarship. The board may sue in its own name any person who fails to fulfill his obligations under a contract for a loan or scholarship. Refusal to comply with a decision of the board relating to the method of repayment of a loan or scholarship may constitute grounds for revocation of license as provided for in KRS 311.565. (1954, c. 136, § 6; effective June 17, 1954)

211.325 Contracts with medical schools. The board may make inquiry of medical colleges and schools, and make arrangements and enter into contracts with such institutions for the admission of students granted loans or scholarships by the board. The board may cancel any contract made with any college or school. (1954, c. 136, § 7; effective June 17, 1954)

211.330 Trust or agency fund. Funds appropriated for the purposes of the medical scholarship program and all sums received in repayment of loans and scholarships shall be placed in the State Treasury to the credit of a trust or agency fund for carrying out this program. Loan and scholarship payments shall be made out of this fund on a requisition to the Department of Finance signed by the secretary of the board. (1954, c. 136, § 8; effective June 17, 1954)

DENTAL SCHOLARSHIPS

211.405 Purpose of Rural Dental Scholarship Fund. In enacting legislation relating to a Rural Kentucky Dental Scholarship Fund, the General Assembly has as its purpose the allevation of the shortage of dentists in certain rural areas of the Commonwealth. (1958, c. 35, § 1; effective June 19, 1958)

211.410 Definition for KRS 211.405 to 211.460. As used in KRS 211.405 to 211.460, unless the context requires otherwise, "Board" means the Kentucky State Board of Dental Examiners. (1958, c. 35, § 2; effective June 19, 1958)

211.420 Rural Kentucky Dental Scholarship Fund; granting scholarships. (1) There is hereby established within the Department of Health, a Rural Kentucky Dental Scholarship Fund.

(2) Commencing July 1, 1958, there shall be available each fiscal year to applicants selected by the board with the approval of the Dental Division of the State Department of Health, ten scholarships for the study of dentistry leading to the attainment of the degree of Doctor of Dental Surgery, or some equivalent degree. If in any years less than ten scholarships are awarded, the number available but not granted shall be carried over and added to those available in succeeding years.

(3) A scholarship shall not exceed one thousand five hundred dollars per annum. No recipient of a scholarship shall receive more than six thousand dollars for his entire course of dental study.

(4) In granting scholarships the board shall make a careful and full investigation of the ability, character and qualifications of each applicant, and may personally examine each applicant. The board shall, whenever possible, grant financial assistance to the applicants with the greatest financial need, provided such persons are found to possess such qualities as give reasonable assurance of their successfully completing the course of study made possible by the scholarship. (1958, c. 35, § 3; effective June 19, 1958)

211.430 Eligibility of applicants; contract to practice. (1) To be eligible for a scholarship made available under KRS 211.405 to 211.460, an applicant must:

(a) Have been a resident of this Commonwealth for not less than five years immediately preceding the date of application;

(b) Be acceptable for enrollment in a dental school accredited by the Council on Dental Education of the American Dental Association, and approved by the board; and

(c) Furnish satisfactory evidence to the board that he does not have sufficient financial resources to enable him to study dentistry without assistance.

(2) Before a scholarship is granted, the applicant shall contract in writing with the board, that he will, within six months from the date he completes his term of study, engage in the practice of dentistry in a locality or localities within this Commonwealth to be designated by the Dental Division of the State Department of Health, at the rate of one year for each one thousand five hundred dollars received, or proportional time for lesser amounts. (1958, c. 35, § 4; effective June 19, 1958)

211.440 Effect of breach of contract. (1) If the recipient of a scholarship fails, without justifiable cause to practice dentistry in the locality designated, the entire amount of scholarship benefits received under the provisions of KRS 211.405 to 211.460 plus six percent interest thereon, shall become due and payable. However, where the board determines there is justifiable cause for the failure to practice, it may relieve the recipient of the obligation to practice, and shall provide for repayment of the amount received plus six percent interest on any terms it deems proper.

(2) Upon recommendation of the board, the Attorney General shall institute proceedings for the purpose of recovering any amount due the Commonwealth under the provisions of this section.

(3) Failure of a recipient of a scholarship to perform his obligations with respect to his contract to practice in a designated locality shall constitute grounds for revocation of his license to practice dentistry within the Commonwealth. (1958, c. 35, § 5; effective June 19, 1958)

211.450 Administrative regulations. The board may promulgate reasonable rules and regulations for the purpose of carrying out the provisions of KRS 211.405 to 211.460. (1958, c. 35, § 6; effective June 19, 1958)

211.460 Disposition of funds. Funds appropriated for the purpose of the Rural Kentucky Dental Scholarship Fund, and sums received as a result of violations of service agreements shall be placed in the State Treasury to the credit of a trust or agency fund for the purpose of carrying out the provisions of KRS 211.405 to 211.460. Provided, however, that any sums in excess of fifty thousand dollars at the end of each biennium shall revert to the General Fund. (1958, c. 35, §7; effective June 19, 1958)

KENTUCKY COMMISSION ON AGING

211.510 Definition for KRS 211.510 to 211.560. As used in KRS 211.510 to 211.560, unless the context otherwise requires, "commission" means the Kentucky Commission on Aging. (1962, c. 106, Art. XIII, § 1)

Note: KRS 211.510 takes effect July 1, 1962.

211.520 Kentucky Commission on Aging. (1) There is hereby created a Kentucky Commission on Aging, within the Health and Welfare Agency. The commission shall consist of sixteen members and shall include the Commissioner of the Department of Health, the Commissioner of the Department of Mental Health, the Commissioner of the Department of Economic Security, the Superintendent of Public Instruction and twelve members to be appointed by the Governor, not more than three of whom may be employes of the Commonwealth. A chairman of the commission shall be elected at the first meeting and annually thereafter.

(2) Of the citizen members first appointed four shall serve for terms of one year, four for terms of two years and four for terms of three years. At the expiration of these terms appointments shall be for terms of three years. All citizen members shall be eligible for reappointment and shall serve until their successors have been appointed and qualified. Vacancies occurring prior to the expiration of a term shall be filled by the Governor for the remainder of the unexpired term.

(3) The commission shall meet at least six times annually on call of the chairman or on the written request of any eight members. A majority of the members of the commission shall constitute a quorum for the transaction of business. If at any time the Commissioner of the Department of Health, the Commissioner of the Department of Mental Health, the Commissioner of the Department of Economic Security or the Superintendent of Public Instruction is unable to attend a commission meeting, he shall designate another person who has authority to act in his behalf at the meeting and who shall be considered a member of the commission for the purpose of obtaining a quorum and transacting business. (1962, c. 106, Art. XIII, § 2)

Note: KRS 211.520 takes effect July 1, 1962. Health and Welfare Agency, KRS 12.022

211.530 Staff assistance and administration. The administrator of the Health and Welfare Agency shall provide the commission with staff assistance, and shall administer the program of the commission. (1962, c. 106, Art. XIII, § 3)

Note: KRS 211.530 takes effect July 1, 1962.

211.540 Expenses of citizen members; advisory committees. (1) The citizen members of the commission shall be reimbursed for necessary travel and other expenses incurred in the performance of their duties.

(2) The commission may create such advisory committees as it deems necessary and shall designate a commission member as chairman of each advisory committee. (1962, c. 106, Art. XIII, § 4)

Note: KRS 211.540 takes effect July 1, 1962.

211.550 Duties of commission. The duties of the commission shall be to:

(1) Promote and aid in the establishment of local programs and services for the aging;

(2) Conduct programs to educate the public as to problems of the aging;

(3) Review existing state programs of the aging and to make recommendations to the Governor, to the appropriate departments and agencies of the state, and to the legislature for improvements in and additions to such programs;

(4) Assist and encourage governmental and private agencies to coordinate their efforts on behalf of the aging;

(5) Conduct and encourage other organizations to conduct studies concerning the aging;

(6) Establish, in selected areas and communities of the state, programs of services for the aging to demonstrate the value of such programs, and to encourage local agencies to continue the programs and to create new services where needed. Emphasis shall be given to services designed to foster continued participation of older people in family and community life and to lessen the need for institutional care;

(7) Cooperate with the federal government and with the governments of other states in programs relating to the aging. (1962, c. 106, Art. XIII, § 5)

Note: KRS 211.550 takes effect July 1, 1962.

211.560 Acceptance and disposition of gifts and grants. The commission shall be empowered to accept gifts and grants at its discretion. Such moneys shall go into a trust and agency fund to be disbursed by the commission in furtherance of the purposes of KRS 211.510 to 211.560. (1962, c. 106, Art. XIII, § 6)

Note: KRS 211.560 takes effect July 1, 1962.
Handling private funds and contributions, KRS 41.290

KENTUCKY COMMISSION ON CHILDREN AND YOUTH

211.610 Definition for KRS 211.610 to 211.650. As used in KRS 211.610 to 211.650, unless the context otherwise requires, "commission" means the Kentucky Commission on Children and Youth. (1962, c. 106, Art. XIV, § 1)

211.620 Kentucky Commission on Children and Youth. (1) There is hereby created within the Health and Welfare Agency, a Kentucky Commission on Children and Youth. The commission shall consist of the commissioners of the Departments of Child Welfare, Economic Security, Health, and Mental Health, the Superintendent of Public Instruction, the chief executive officer of the Commission for Handicapped Children, and eighteen members to be appointed by the Governor. A chairman of the commission shall be elected at the first meeting and annually thereafter.

(2) Of the eighteen members first appointed by the Governor, four shall serve for terms of one year, four for terms of two years, five for terms of three years, and five for terms of four years. At the expiration of these terms, appointments shall be for terms of four years. All appointed members shall be eligible for reappointment and shall serve until their successors have been appointed and qualified. Vacancies occurring prior to the expiration of a term shall be filled by the Governor for the remainder of the unexpired term.

(3) The commission shall meet at least two times annually on call of the chairman or on the written request of any thirteen members. A majority of the members of the commission shall constitute a quorum for the transaction of business. (1962, c. 106, Art. XIV, § 2)

Health and Welfare Agency, KRS 12.022

211.630 Staff assistance; advisory committees; expenses of members. (1) The administrator of the Health and Welfare Agency shall furnish the commission with necessary staff assistance, through either an administrative services unit of the agency or the facilities of a department within the agency.

(2) The commission may appoint such advisory committees as are necessary to advise it on specific matters relating to children and youth.

(3) Members of the commission shall serve without compensation but shall be reimbursed for necessary and actual expenses incurred in attending commission meetings. (1962, c. 106, Art. XIV, § 3)

211.640 Duties of commission. The duties of the commission shall be to:

(1) Promote and develop effective programs of education, health, recreation, welfare, public safety and correctional services for children and youth;

(2) Conduct continuing programs of public information to educate the public as to problems of children and youth;

(3) Assist and encourage governmental and private agencies to coordinate their efforts on behalf of children and youth;

(4) Cooperate with the Federal Government and with the governments of other states and cities in programs relating to children and youth;

(5) Conduct programs of research as to the needs of children and youth in order to facilitate more comprehensive and better related social planning and action;

(6) Cooperate with the Department of Child Welfare, the Department of Economic Security, the Department of Health, the Department of Mental Health and the Commission for Handicapped Children in carrying out the duties prescribed by this section by making the fullest possible use of the experience and resources of those departments;

(7) Furnish the Governor a biennial report together with recommendations. (1962, c. 106, Art. XIV, § 4a)

211.650 Acceptance and disposition of gifts and grants. The commission shall be empowered to accept gifts and grants at its discretion. Such funds shall go into a trust and agency fund to be disbursed in furtherance of the purposes of KRS 211.610 to 211.650. (1962, c. 106, Art. XIV, § 4b)

Handling private funds and contributions, KRS 41.290

PENALTIES

211.990 Penalties. (1) Any owner or occupant who fails to comply with an order made under the provisions of KRS 211.210 shall be fined not less than ten dollars nor more than one hundred dollars, and each day's continuance of the nuisance, source of filth or cause of sickness, after the owner or occupant has been notified to remove it, shall be a separate offense.

(2) Except as otherwise provided by law, anyone who fails to comply with the provisions of the rules and regulations adopted pursuant to this chapter or who fails to comply with an order of the department issued pursuant thereto shall be fined not less than ten dollars nor more than one hundred dollars. Each day of such violation or noncompliance shall constitute a separate offense.

(3) Any person who violates any provision of KRS 211.182 shall, upon first offense, be fined not less than $1,000 nor more than $5,000, or confined in the county jail for not less than thirty days nor more than twelve months, or both. Each subsequent violation of any provision of KRS 211.182 shall constitute a felony and be punishable by a fine of not less than $3,000 nor more than $10,000, or by imprisonment in the penitentiary for not less than one nor more than three years, or both. (1954, c. 157, § 23; subsection (3) added, 1960, c. 47, § 7)

used by the department in carrying out the provisions of this chapter. No part of this fund shall revert to the general fund of the Commonwealth. (1960, c. 102, § 5; effective July 1, 1960)

223.060 Reciprocal registration agreements with other states. The department is authorized to enter into reciprocal agreements with other states having a registered sanitarian's act, provided the qualifications of such state are at least equal to the requirements of this chapter and the regulations promulgated hereunder. (1960, c. 102, § 6; effective July 1, 1960)

223.070 Grounds for revocation of certificate. The department shall have the power to revoke the certificate of registration of any registrant for unprofessional conduct or the practice of any fraud or deceit in obtaining registration, or any gross negligence, incompetency, or misconduct in the practice of public health sanitation. (1960, c. 102, § 7; effective July 1, 1960)

223.080 Unregistered person may not hold himself out as registered sanitarian. No person not registered under the provisions of this chapter shall hold himself out as a registered sanitarian nor append to his name the initials "R.S." (1960, c. 102, § 8; effective July 1, 1960)

WATER AND SEWAGE PLANT OPERATORS

223.160 Operators of water treatment and sewage treatment plants to have certificate of competency. It is the intent of KRS 223.160 to 223.220 and 223.991 that every operator in responsible charge of a water treatment plant, water distribution system, and sewage treatment plant be required to hold a valid and effective certificate of competency issued by the State Department of Health in a class equal to or higher than the class of the particular treatment plant or distribution system where he is currently employed in order to protect the public health. Operators other than those in responsible charge of such facilities shall also be eligible to apply for certification. (1966, c. 156, § 1)

223.170 Certification of competency; Board of Certification; members; compensation. The State Department of Health shall certify persons as to their qualifications to supervise successfully the operation of water treatment plants, water distribution systems, and sewage treatment plants after considering the recommendations of a Board of Certification which shall be appointed by the Commissioner of Health. The board shall consist of the following: two members who are currently employed water works operators holding valid certificates; two members who are currently employed as sewage treatment plant operators holding valid certificates; one member employed by a municipality who holds the position of either city manager, city engineer, director of public works, or the equivalent thereof; one member who is a faculty member of a college, university, or professional school whose major field is related to water supply and sewage treatment; and one ex officio member representing the State Department of Health. Board members shall serve for a four year term or until their successors are appointed and qualify. The State Health Department representative shall serve as executive secretary and treasurer of the board and be responsible for maintaining records. The members of the board shall serve without compensation, but may be reimbursed for all actual and necessary expenses incurred while discharging their official duties. (1966, c. 156, § 2)

223.180 Plants to be classified according to skills required for operation. The State Department of Health shall classify all water treatment plants, water distribution systems, and sewage treatment plants with due regard to size, type, physical conditions affecting such treatment plants and distribution systems, and according to the skill, knowledge and experience that the operator must have to supervise successfully the operation of such water treatment plants, water distribution systems, and sewage treatment plants so as to protect the public health. (1966, c. 156, § 3)

223.190 Supervisors of plants to be certified as to competency. One year following June 16, 1966, all water treatment plants, water distribution systems, and sewage treatment plants, whether publicly or privately owned, shall be under the supervision of an operator whose competency is certified to by the State Department of Health in a grade corresponding to the classification of the water supply system or sewage treatment plant to be supervised. All operators holding valid and effective certificates issued under existing regulations of the State Board of Health on June 16, 1966 may, within the discretion of the State Department of Health, be issued new certificates without examination for any appropriate new classifications that may be established by the regulations adopted hereunder or such certificates may be continued in effect. (1966, c. 156, § 4)

223.200 Rules and regulations of Board of Health as to certification of water and sewage plant operators. (1) The State Board of Health, with the advice of the Board of Certification, shall adopt rules and regulations as are reasonably necessary to carry out the intent of KRS 223.160 to 223.220 and 223.991. The rules and regulations may include, but are not limited to, provisions establishing standards for classification of water treatment plants, water distribution systems, and sewage treatment plants, provisions establishing qualifications of applicants and procedures for examination of candidates, membership, and duties of the Board of Certification, provisions relating to the renewal, cancellation or revocation of certificates, including the specifications of the grounds therefor, and such other provisions as are necessary for the administration of KRS 223.160 to 223.220 and 223.991.

(2) All rules and regulations heretofore adopted by the State Board of Health relating to the certification of operators of water treatment plants, water distribution systems, and sewage treatment plants and on file with the Legislative Research Commission on June 16, 1966 are hereby declared to be in full force and effect until otherwise amended or repealed. (1966, c. 156, § 5)

223.210 Operation of plant without certificate prohibited; provisonal certificates. On and after one year following June 16, 1966 it shall be unlawful for any person, firm, or corporation, (municipal or private) to operate a water treatment plant, water distribution system or sewage treatment plant unless the competency of the operator who is in direct responsible charge is duly certified to by the State Department of Health under the provisions of KRS 223.160 to 223.220 and 223.991. It shall be unlawful for any person to perform the duties of an operator, in direct responsible charge, without being duly certified under the provisions of KRS 223.160 to 223.220 and 223.991. The State Department of Health may, however, issue provisional certificates for emergency situations. (1966, c. 156, § 6)

223.220 Fees for examination and certificates. The State Board of Health is authorized to fix a reasonable schedule of fees and charges by regulation to be paid by applicants for examinations, certificates, and renewal certificates. All such fees and charges and other monies collected by the State Department of Health under the provisions of KRS 223.160 to 223.220 and 223.991 or the rules and regulations of the State Board of Health shall be paid into the State Treasury and credited to a trust and agency fund to be used by the State Department of Health in carrying out the provisions of KRS 223.160 to 223.220 and 223.991. (1966, c. 156, § 7)

223.990 Penalty. Any person violating KRS 223.080 may be fined not more than one hundred dollars or imprisoned not more than six months. (1960, c. 102, § 8; effective July 1, 1960)

223.991 Penalties. Any person, firm or corporation (municipal or private) violating any provisions of KRS 223.160 to 223.220 or the rules and regulations adopted thereunder is guilty of a misdemeanor and shall be punished by a fine or not less than ten dollars nor more than one hundred dollars. Each day of operation in violation of KRS 223.160 to 223.220 or of the rules and regulations adopted thereunder shall constitute a separate offense. (1966, c. 156, § 8)

KENTUCKY
PUBLIC WATER SUPPLIES
AND
FLUORIDATION REGULATIONS

1968

Issued By The
KENTUCKY STATE DEPARTMENT OF HEALTH
Sanitary Engineering Program
Division of Environmental Health
275 East Main Street
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KENTUCKY
PUBLIC WATER SUPPLIES
AND
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S-ENG-1-1

PUBLIC WATER SUPPLIES

Relates to KRS Chapter 211
Superseded: S-ENG-1 in its entirety

Pursuant to the authority of KRS 211.090(1)(D) and 211.180:

1. Scope. The provisions of this regulation apply to all "Public Water Supplies", including all facilities incident thereto. The purpose of this regulation is to provide bacteriological and chemical standards and other standards for the operation and maintenance of public water supplies so that health and safety hazards will be minimized. This regulation does not apply to private water supplies. The certification of operators of water treatment plants and water distribution systems is governed by State Board of Health Regulation S-ENG-4-1.

2. Definitions. The following terms shall have the meanings set forth below unless the context clearly indicates otherwise:

(1) "Department" means the State Department of Health;

(2) "Person" means any individual, firm, corporation, officer or employee thereof, association, public institution, municipality, county, partnership, company, governmental agency, club, organization of any kind, or any political subdivision of the Commonwealth of Kentucky;

(3) "Public Water Supply" means any water supply serving the public irrespective

of its ownership or operation and made available for drinking and/or domestic use;

(4) "Private Water Supply" means a residential water supply located on private property under the control of the homeowner, the use of which is limited to members of his family;

(5) "Auxiliary Intake" means any piping connection or other device whereby water may be secured from a source other than that normally used;

(6) "By-Pass" means a physical arrangement whereby water may be diverted around any feature of the purification process of a public water supply;

(7) "Cross Connection" means any physical arrangement whereby a public water supply system is connected, directly or indirectly, with any other water supply system, sewer, drain, conduit, storage reservoir, plumbing fixture, or any other device which contains, or may contain, contaminated waters, sewage, or other waste or liquid which would be capable of imparting contamination to the public supply as a result of backflow or back siphonage;

(8) "The Coliform Group of Bacteria" includes all aerobic and facultative anaerobic Gram-negative non-spore forming bacilli which ferment lactose with gas formation within 48 hours at 35°C.

3. Operation. No public water supply shall be operated after the effective date of this regulation unless it complies with the minimum requirements pro vided herein. Water supplies constructed prior to t effective date of this regulation may be continued i use provided the operation and maintenance complies with the sanitary and safety requirements herein.

4. Submission of Plans for Water Supplies. No person shall begin construction, or construct, or in stall, or substantially change, alter or reconstruct any existing facilities or works in any public water supply until plans and specifications, together with an engineering report supporting in detail design da as may be required for the proper review of the plan have first been submitted in triplicate to the Department through the county Department of Health con cerned and have been approved in writing. Plans and specifications, reports and other information shall submitted of such form and contents as may be specif by the Department. The front page of the plans shal contain the name of the water supply, location by ci and county, and name of the engineer, architect or person preparing the plans. Plans submitted by an engineer or architect shall bear his seal. Plans an specifications on public water supplies constructed by the State or political subdivision thereof shall prepared by an engineer or architect registered in t State of Kentucky and comply with provisions of KRS 322.360. The review of plans by the Department is limited only to the sanitary features of design and other features of public health significance and doe not include the examination of structural, mechanica or electrical design nor economic factors.

(1) The plans shall be drawn to scale and accompanied by proper specifications so as to permit a comprehensive engineering review including the piping and hydraulic details and shall include:

- (A) A plan and sectional view with all necessary dimensions of both water treatment facilities and surrounding area;
- (B) A piping diagram showing all appurtenances including treatment facilities in sufficient detail, as well as pertinent elevation data, to permit a hydraulic analysis of the system;
- (C) The specifications shall contain details on all treatment equipment, including catalog identification of pumps, chlorinators, chemical feeders and related equipment;

(2) Upon completion of the construction a statement shall be submitted by the engineer, architect or person who prepared plans, certifying that the water works project has been completed in accordance with the approved plans and specifications; and

(3) Unless construction is begun within one year from date of approval, the approval shall expire. Extension of approval may be granted upon written request to the Department.

5. Inspection. The Department is authorized to conduct such inspections as it deems necessary to insure compliance with all provisions of this regulation and shall have the right of entry at any reasonable time to the public water purification plant or treatment works for this purpose.

6. Submission of Reports of Operation. Reports of operation shall be submitted by water plant operators at the end of each month or at such other intervals as may be required by the Department. Reports shall be submitted on forms prescribed or approved by the Department.

7. Chlorination. The proper dosage of chlorine shall be determined by regular and frequent routine bacteriological and residual chlorine tests, both at the plant and at various points in the distribution system. A contact period of at least 30 minutes shall be provided between the chlorine and the water to allow adequate time for disinfection.

8. Disinfection of Water Supply Systems. All new water distribution systems including storage distribution tanks and repaired portions of, or extensions to existing systems shall be thoroughly disinfected before being placed in service, by the use of chlorine or chlorine compounds in such amounts as to produce a concentration of at least 50 PPM and a residual of at least 25 PPM at the end of 24 hours and followed by thorough flushing.

9. Disinfection Feed Equipment. The water purification plant or treatment works shall be equipped with a chlorinator, hypochlorinator, or other feeder used for applying a disinfectant, which meets the following requirements:

(1) Be of sturdy construction and materials which will withstand wear, corrosion, or attack by disinfectant solutions or vapors and which are not adversely affected by repeated regular adjustments or other conditions anticipated in the use of the device. The feeder shall be capable of being easily disassembled for cleaning and maintenance. The design and construction shall be such as to preclude stoppage

from chemicals intended to be used or foreign materials that may be contained therein. The feeder shall incorporate failure-proof features;

(2) Be capable of supplying the maximum rates required for pre and post chlorination;

(3) Have a graduated and clearly marked dosage adjustment to provide flows from full capacity to 25% of such capacity. The device shall be capable of continuous delivery within 10% of the dosage at any setting;

(4) When the disinfectant is introduced at the suction side of the pump, a device or method shall be provided to prevent air lock of the pump;

(5) When compressed chlorine gas is used, the following additional features shall be provided:

(A) Where chlorine gas is used as a disinfectant the chlorinator and any cylinders containing chlorine gas used therewith shall be housed in a separate enclosure separated by a tight partition wall or by a tight partition wall with a door so installed as to prevent leakage and equipped with an inspection window. A separate opening provided with an electric motor-driven fan exhausting to the outside shall be located at the floor level when such chlorinator enclosure is located above the surface of the ground. When such chlorinator is located below the surface of the ground, an electric motor-driven exhaust fan shall be provided, taking suction from near the floor level of the underground enclosure and discharging at a suitable point to the exterior above the ground level. The switch for the operation of the motor of such exhaust fan shall be located at an accessible point outside of the enclosures where the switch will not be exposed to chlorine gas in the event of gas leakage;

(B) The chlorinator equipment shall be of rugged design, capable of withstanding wear without developing leaks;

(C) Chlorine cylinders shall be anchored to prevent their falling over. Scales must be provided for weighing chlorine cylinders. A valve stem wrench shall be maintained on the chlorine cylinder so the supply can be shut off quickly in the case of an emergency. Valve protection hood shall be kept in place except when the cylinder is connected;

(D) The chlorine feeding device shall be designed so that during accidents or interruptions of the water supply, leaking chlorine gas will be conducted to the out-of-doors;

(E) Chlorinator shall be a solution feed type, capable of delivering chlorine at its maximum rate without releasing chlorine gas to the atmosphere;

(F) The chlorinators shall be designed to prevent the backflow of water into the chlorine solution container;

(G) Chlorinators shall be equipped with siphon breakers to prevent back siphonage of concentrated chlorine solution into the distribution system;

(H) A gas mask designed for use in a chlorine atmosphere and of a type approved by the U. S. Bureau of Mines shall be provided. In addition, replacement canisters shall be provided and a record shall be kept of gas mask usage to insure that the mask will be serviceable when needed;

(I) The gas mask shall be kept in a closed cabinet, accessible without a key, located outside of the room in which the chlorinator is maintained; and

(J) Installation of chlorinator equipment, and operation thereof, shall be carried on by and under the supervision of personnel experienced with installation and operation of such equipment.

(6) When a hypochlorite solution is used to be fed through hypochlorinator equipment, such equipment shall also provide the following additional features:

(A) Feeder shall be electrically operated and provide positive displacement under all conditions of pressure and without artificial constriction of the pump suction line;

(B) Regulation shall be provided to insure constant feed with varying supply or back pressure;

(C) Positive features to prevent backflow to the solution container, an provision for reducing to a minim the entry into the water of free calcium released from calcium hypochlorite; and

(D) Provision to prevent siphoning of hypochlorite solution when the hypochlorinator is turned off.

(7) Equipment and piping used to apply chemicals to the water shall be of such size, design, and material that they may be cleaned and will be free from clogging. All material used for such equipment and piping shall be resistant to action of chemicals to be used therein.

10. Cross-Connections, By-Passes, and Auxiliary Intakes.

(1) Cross-Connections Prohibited - All cross-connections regardless of whether or not such cross-connections are controlled by automatic devices, such as check-valves, or by hand operated mechanisms such as gate-valves or stopcocks, are hereby prohibited.

(2) By-Passes Prohibited or Approved - No by-passes shall be established or maintained whereby water may be directed around any feature of a water purification process of a public water supply system without the specific approval of the Department.

(3) Auxiliary Intakes Prohibited - No auxiliary intake shall be used in direct connection with a public water supply system except with the express approval of the Department during a period of emergency.

11. Sewer and Waste Connections. The sanitary sewer serving the purification plant and auxiliary facilities, including all plumbing fixtures, toilets, showers, drinking fountains and floor drains shall discharge to the public sewer system wherever possible. Where no such sewer is available the connection shall be made to a suitable sewage disposal facility approved by the Department. There shall be no direct physical connection between the sewer system and any filter back wash, and filter-to-waste drains, or clear well overflow lines. A suitable air gap must be provided between such drains and overflow lines and the approved sanitary, storm sewer, or natural drainage system as to preclude possibility of backup of sewage or waste into the drain and overflow lines.

12. Sampling.

(1) The bacteriological examination of water shall be of samples collected at representative points throughout the distribution system. The frequency of sampling and the location of sampling points on the distribution system shall be such as to determine properly the bacteriological quality of the water supply.

(2) The bacteriological samples shall be collected by a qualified or authorized person in bottles especially prepared a sterilized by the Department. The wate sample must be freed of any disinfectin agent immediately at the time of its collection.

13. Standard Bacteriological Tests and Water Quality. The standard test for the coliform group shall be either by the multiple tube fermentation technique (presumptive test, confirmed test, or completed test) or by the membrane filter technique as described in the latest edition of "Standard Methods for the Examination of Water and Wastewater" published by the American Public Health Association. No water shall be provided or rendered available for use to the public for drinking and domestic use which does not meet the bacteriological standards as set forth below and as contained in the latest edition of U. S. Public Health Service Drinking Water Standards.

(1) Bacteriological Standards. (Multiple-Tube Fermentation Technique) The standard portion of water for the application of the bacteriological test may be either 10 milliliters or 100 milliliters. The standard sample for the bacteriological test shall consist of five standard portions of either 10 milliliters or 100 milliliters each.

(A) When the 10 milliliter portions are used as the standard portion of water for the bacteriological test, not more than 10 percent of the total number examined per month shall show the presence of the organisms of the coliform group. Occasionally three or more of the five equal 10 milliliter portions constituting a single standard sample may show the presence of organisms of the coliform group, provided this shall not be allowable if it occurs in two consecutive samples or in more than five percent of the standard samples when twenty or more have been examined per month; or in one standard sample when less than twenty samples have been examined per month. Provided further, that when three or more of the five equal 10 milliliter portions constituting a single standard sample show the presence of organisms of the coliform group, daily samples from the same sampling point shall be collected promptly and examined until the results obtained from at least two consecutive samples show the water to be of satisfactory quality.

(B) When 100 milliliter portions are used as the standard portion of water for the bacteriological test, not more than 60% of all examined per month shall show the presence of organisms of the coliform group. Occasionally all of the five equal one hundred milliliter portions constituting a single standard sample may show the presence of organisms of the coliform group provided that this shall be allowable if it occurs in two consecutive samples or in more than 20% of the standard samples when five or more samples have been examined per month or in one standard sample when less than five samples have been examined per month: and provided further, that when all five of the standard one hundred milliliter portions constituting a single standard sample of the coliform group, daily samples from the same sampling point shall be collected promptly and examined until the results obtained from at least two consecutive samples show the water to be of satisfactory quality.

(2) Bacteriological Standards. (Membrane Filter Technique) When the membrane filter technique is used the arithmetic mean coliform density of all standard samples examined per month shall not exceed one per 100 ml. Coliform colonies per standard sample shall not exceed 3/50 ml, 4/100 ml, 7/200 ml, or 13/500 ml in: two consecutive samples; more than one standard sample when less than twenty are examined per month; or more than five percent of the standard samples when twenty or more are examined per month. When coliform colonies in a single standard sample exceed the above values, daily samples from the same sampling point shall be collected promptly and examined until the results obtained from at least two consecutive samples show the water to be of satisfactory quality.

(3) Physical Standards. The turbidity of the water shall not exceed 5 units (silica scale); the color shall not exceed 15 units (platinum cobalt scale); nor shall the threshold odor number exceed 3.

(4) Chemical Standards. The water shall not contain an excessive amount of soluble mineral substance, nor excessive amounts of any chemicals employed in treatment. The following substances shall not occur in treated waters in excess of the recommended maximum limits:

	Mg/Liter (PPM)
Alkyl Benzene Sulfonate (ABS)	0.5
Arsenic (As)	0.01
Barium (Ba)	1.0
Cadmium (Cd)	0.01
Carbon Chloroform Extract (CCE)	0.2
Chloride (Cl)	250.
Chromium (Hexavalent) (Cr + 6)	0.05
Copper (Cu)	1.0
Cyanide (CN)	0.01
Fluoride (F)	1.5
Iron (Fe)	0.3
Manganese (Mn)	0.05
Nitrate (NO_3)	45.
Lead (Pb)	0.05
Phenols	0.001
Selenium (Se)	0.01
Silver (Ag)	0.05
Sulfate (SO_4)	250.
Zinc (Zn)	5.

Radioactivity shall not occur in treated waters in excess of the recommended maximum limits:

Radium (Ra) -226	3 Pc/Liter
Strontium (Sr) -90	10 Pc/Liter
Gross Beta Concentration	1000 Pc/Liter

The following chemical substances shall not occur in treated waters in excess of the maximum allowable limits:

	Mg/Liter (PPM)
Arsenic (As)	0.05
Barium (Ba)	1.0
Cadmium (Cd)	0.01
Chromium (Hexavalent) (Cr + 6)	0.05
Cyanide (CN)	0.2
Fluoride (F)	1.5
Lead (Pb)	0.05
Selenium (Se)	0.01
Silver (Ag)	0.05

Radioactivity shall not occur in treated waters in excess of the maximum allowable limits:

Radium (Ra) -226	3 Pc/Liter
Strontium (Sr) -90	10 Pc/Liter
Gross Beta Concentration	1000 Pc/Liter

Total solids shall not exceed 500 Mg/Liter for a water of good chemical quality. However, if such water is not available, a total solids content of 1,000 Mg/Liter may be permitted if approved by the Department in writing. Other substances with deleterious physiological effect shall not be allowed in the water supply.

ADOPTED:	July 20, 1967
FILED:	August 1, 1967
EFFECTIVE:	August 31, 1967

S-ENG-2-1

FLUORIDATION OF PUBLIC WATER SUPPLIES

Relates to KRS Chapter 211
AMENDS Section 1 of S-ENG-2

Pursuant to the authority of KRS 211.090(1)(d) and 211.180:

1. Adjustment of Fluoride Deficient Waters to Optimum in Supplies Serving Cities of the 1st, 2nd, 3rd and 4th Class and Water Districts Serving Equivalent Populations; Approval by Department.

(1) Water suppliers to cities of the first, second, third or fourth classes or to water districts serving equivalent populations, shall adjust fluoride deficient waters to an optimum fluoride content for the protection of the dental health of the people served by the supply.

(2) Approval by the State Department of Health of the addition of fluorides to a public water supply shall be contingent upon the presentation of satisfactory evidence that the plant facilities and operation will provide for the adequate control and supervision, safe operation and maintenance, keeping of operational records, and compliance with this regulation and other regulations of the State Board of Health relating to public water supplies. Effective: July 22, 1966

2. Procedure for Obtaining Approval. There shall be submitted in support of any application for approval the following:

Detailed plans showing the method and point of application of fluoride and storage facilities for stc chemicals, together with information concerning technical supervision of the treatment process and provision for laboratory facilities.

3. Requirements Relating to Equipment, Facilitie and Services. The equipment, facilities, and services shall comply with the requirements set forth below:

(1) Reliable feeding equipment with an accuracy within 5 per cent shall be provided to feed the proper dosage of fluoride. The rate of feed shall be such as to give a fluoride content of 1.0 ppm to 1.5 ppm in the treated water. The point of application shall be selected so that the fluoride will be evenly mixed with the water leaving the treatment plant.

(2) If solution feed equipment is to be used, a minimum of two corrosion resistant solution tanks and accurate means for weighing the stock chemical and measuring the water for the solution shall be provided. Dry feed hoppers shall be mounted on scales.

(3) Special precautions shall be taken to protect the operators from inhaling the fluoride. Such precautions may vary with the type of installation, but the minimum shall be the provision of a toxic-dust respirator for each operator. Adequate exhaust systems shall be provided for dry feeding equipment.

(4) Locked separate storage facilities for the fluoride chemical shall be provided.

(5) Laboratory facilities shall be provided for the determination of the fluoride content of the water by competent personnel, in accordance with the procedure outlined in the latest edition, "Standard Methods for the Examination of Water, Sewage and Industrial Wastes," shall be regarded as the official method in determining fluoride residuals.

(6) Samples of raw water and plant effluent and samples from the distribution system shall be examined a minimum of once each day and the results included on the standard operation report submitted to the State Department of Health. Samples from the distribution system shall be sent to the State Department of Health at biweekly intervals for fluoride analysis until directed otherwise.

(7) Fluoride feeders shall be equipped with siphon breakers to prevent back siphonage of concentrated fluoride solution into the distribution system.

(8) The State Department of Health shall be notified of the date on which fluoridation is to commence in order that a representative of the Department may be present to calibrate and check the fluoridation equipment and instruct the operating personnel concerning tests, records, operation and safety precautions.

4. Notice of Interruption or Discontinuance of Fluorides to Water Supply.

(1) The State Department of Health shall be immediately notified by the operator or owner of the water plant of an interruption to the addition of fluoride to the water supply.

(2) In the event of the discontinuance of fluorides to the water supply at least 30 days prior written notice shall be given to the State Department of Health

(S-ENG-2, EFFECTIVE: March 3, 1963)

WATER PLANT RATING

Date of Inspection ______________

Name of Plant ______________________

Location of Plant ____________________

☐ APPROVED — None of the items listed below.

☐ PROVISIONAL

- ☐ (1) Superintendent not certified
- ☐ (2) Not submitting monthly operation reports
- ☐ (3) Not submitting bacteriological samples
- ☐ (4) Uncovered storage tank ☐ No screens on clear well and storage tank vents
- ☐ (5) Inadequate retention time in ☐ Flocculation basin ☐ Settling basin
- ☐ (6) Lack of Laboratory equipment (pH - Cl_2)
- ☐ (7) Inadequate treatment process
- ☐ (8) Poor plant housekeeping and maintenance
- ☐ (9) Low pressures in distribution system
- ☐ (10) No master meter
- ☐ (11) No flash mix or inadequate quick mix arrangement
- ☐ (12) Inadequate clear well capacity
- ☐ (13) Inadequate overhead storage
- ☐ (14) Filters not equipped with loss-of-head gauges and rate-of-flow controllers
- ☐ (15) Temporary mechanical failure, such as inoperative chlorinator or temporary depletion of chlorine and other water treatment chemicals
- ☐ (16) Plant operated near or at maximum daily capacity
- ☐ (17) Other -

☐ UNAPPROVED

- ☐ (1) No automatic chlorination
- ☐ (2) Pressure sand filters on surface supply
- ☐ (3) No treatment
- ☐ (4) Cross-connection
- ☐ (5) Repeated contaminated bacteriological samples
- ☐ (6) Plans and specifications not approved by State Department of Health (unless water works is very old - before approval was required under the Regulations)

Inspection made by:

____

Nick G. Johnson

Nick G. Johnson, Director
Sanitary Engineering Program
Division of Environmental Health
Kentucky State Department of Health

SE 7 (1-64)

SANITARY ENGINEERING PROGRAM
KENTUCKY STATE DEPARTMENT OF HEALTH
WATER PLANT INSPECTION REPORT

NAME OF PLANT ______________
LOCATION ______________
PLANT SUPT. ______________
OPERATOR ON DUTY ______________
OTHERS CONTACTED ______________
RATING OF PLANT AT LAST VISIT ______

DATE OF INSPECTION ______________
MAYOR ______________
RATED PLANT CAPACITY ______________
HOURS OPERATED DAILY ______ AVG. GPD ______
NUMBER OF METERS ______________
EXPLANATION OF RATING ______________

RECOMMENDATIONS LAST VISIT ______________

AN INSPECTION OF THIS WATER TREATMENT PLANT HAS BEEN MADE ON THIS DATE AND YOU ARE DIRECTED TO CORRECT CONDITIONS MARKED (X).

A. INTAKE, PUMPS, PIPING
- (1) INTAKE ( )
- (2) LOW SERVICE PUMPS ( )
- (3) HIGH SERVICE PUMPS ( )
- (4) BACKWASH PUMPS ( )
- (5) VALVES ( )
- (6) PIPES ( )

B. AERATION, MIXING, FLOCCULATION & SEDIMENTATION
- (1) AERATION ( )
- (2) RAPID MIX ( )
- (3) FLOCCULATION BASIN ( )
- (4) SEDIMENTATION BASIN ( )
- (5) UP FLOW CLARIFIER ( )
- (6) BASINS CLEANED ______ ( )

C. CHLORINATION AND PH CONTROL
- (1) CHLORINATORS ( )
- (2) PH CONTROL ( )
- (3) CHLORINE AND PH TEST EQUIP. ( )
- (4) PH READING ____ CHLORINE RESIDUAL ______ ( )
- (5) SAFETY PRECAUTIONS ( )
- (6) OTHER ______________ ( )

RESULTS OF CHEMICAL FIELD TESTS ______________

TREATMENT ______________

D. FILTERS & CLEARWELL
- (1) FILTER SAND ( )
- (2) WATER OVER FILTERS ( )
- (3) FILTER WALLS ( )
- (4) RATE-OF-FLOW CONTROLLERS ( )
- (5) LOSS-OF-HEAD GAUGES ( )
- (6) CLEARWELL ( )

E. CHEMICAL FEEDERS & STORAGE
- (1) LIME ( )
- (2) ALUM ( )
- (3) SODA ASH ( )
- (4) CARBON ( )
- (5) FLUORIDE ( )
- (6) OTHER ( )
- (7) CHEMICAL STORAGE ROOM ( )

F. LABORATORY, RECORDS, SAMPLES & MISC.
- (1) LAB. CONTROL ______________ ( )
- (2) MONTHLY OPERATING REPORTS ( )
- (3) NO. OF BACT. SAMPLES SENT ______ ( )
- (4) FLUORIDE SAMPLES SUBMITTED ( )
- (5) MASTER METER ( )
- (6) PLANT HOUSEKEEPING ( )
- (7) MAINTENANCE OF GROUNDS ( )
- (8) CROSS CONNECTIONS ( )
- (9) OPERATORS CERTIFIED ______ ( )

RECOMMENDATIONS THIS VISIT ______________

SE-66A (4-65)

KENTUCKY DEPARTMENT OF HEALTH

SIGNATURE - ENGINEER

KENTUCKY STATE DEPARTMENT OF HEALTH

NOTICE: THIS REPORT SHALL NOT BE CHANGED OR REMOVED EXCEPT BY KENTUCKY STATE DEPARTMENT OF HEALTH PERSONNEL

WATER PLANT INSPECTION REPORT

DATE OF INSPECTION

NAME OF PLANT

LOCATION

OWNER

SOURCE OF SUPPLY

TREATMENT

OPERATOR

COUNTY

DESIGN CAPACITY

POPULATION SERVED

NUMBER OF METERS

DAILY CONSUMPTION (Avg.)

LABORATORY CONTROL

RATING

AN INSPECTION OF YOUR WATER PLANT HAS BEEN MADE THIS DAY AND YOU ARE DIRECTED TO CORRECT CONDITIONS NOTED BELOW.

A. INTAKE

CONDITION

B. LOW SERVICE PUMPS

OPERATING CONDITION

C. AERATION

TYPE AND CONDITION

D. RAPID MIX

CONDITION

E. FLOCCULATION BASIN

CONDITION

LAST CLEANED

F. SEDIMENTATION BASIN

CONDITION

LAST CLEANED

G. UPFLOW CLARIFIER

CONDITION OF UNIT

H. FILTER

NUMBER

SAND

WATER

WALLS

I. FILTER CONTROLS

RATE OF FLOW CONTROLLERS

LOSS OF HEAD GAUGES

EXPLANATION OF SYMBOLS

Water Treatment Processes

Where the treatment is at all extensive, one or more symbols identifying the general type or function of the plant precede those used to identify the particular treatment plant or method. In general, a plant is not classified as a "purification plant" unless filters having fine granular material (sand or anthracite) are used.

Principal treatment features, identified by capitalized letters, are further described by lower case letters following them. In general, the symbols are arranged in the order in which treatment occurs. Combination units performing more than one function in a single structure are denoted by enclosing the appropriate symbols in parentheses. Enclosures in brachets indicate parallel or alternate operation.

Treatment methods are coded as follows:

Type of Plant

P - Purification
H - Softening
I - Iron or Manganese removal
D - Disinfection

Treatment or Device

A - Aeration
Ac..contact beds or trays, coke or other material
Am..patented aerator
As..spray aerator
At..overflow trays cascade or other splash aerator
Ao..other type aerator

C - Chemical dosage for coagulation or softening
Ca..alum
Ci..iron salts
Cl..lime
Cs..soda ash
Ct..activated silica
Co..other coagulant

D - Disinfection
Dc..chlorine gas
Dd..dechlorination
Dh..hypochlorites
Ds..free residual chlorine
Dx..chlorine dioxide
Dz..ozone
Do..Other means

F - Filters
Fa..anthrafilt
Fc..roughing or contact
Fd..diatomaceous earth
Fg..gravity (slow)
Fp..pressure
Fr..gravity (rapid)
Fs..sand
Fz..zeolite

K - Chemical dosage for corrosion correction or water stabilization
Kc..phosphate compounds
Kg..chlorine gas
Kh..hypochlorite
Ko..sodium silicate
Kp..alkali feed for pH adjustment

M - Mixing device or tank
Ma..air agitation
Mb..baffle mix
Mh..hydraulic (standing wave flume)
Mi..injection or pump suction
Mp..slow mechanical mix
Ms..patented sludge blanket
Mt..rapid mechanical mix
(MtpsSv).."Accelator"; "Precipitator"; etc.

N - Ammoniation
Nc..Ammonium compound
Ng..ammonia gas

R - Recarbonation

S - Sedimentation
Sb..basins, baffled (other than inlet or outlet)
Sc...covered basins (other than housed)
Sm..mechanical sludge removal
So..open basin (May be in plant building)
Sv..upflow cylindrical tanks
(MtpsSv).."Accelator"; "Precipitator"; etc.

T - Chemical taste and odor control
Tc..activated carbon
Td..chlorine dioxide
Ts..sulfur dioxide
Tz..ozone
To..other

V - Fluoride adjustment
Va..hydrofluosilicic acid
Vs..sodium silicofluoride
Vt..sodium fluoride
Ve..ammonium silicofluoride
Vo..other fluorides
-V ..fluoride reduction

$V_{1.2}$, 1.2 ppm natural fluoride

J. CLEARWELL

Cover ____________________

____

Vents & Screens ____________________

____

Water ____________________

____

Overflow ____________________

____

K. HIGH SERVICE PUMPS

Operating Condition ____________________

____

____

L. PIPE GALLERY

Pipes ____________________

____

____

Valves ____________________

____

____

Lights ____________________

____

Ventilation ____________________

____

Cross Connection ____________________

____

____

M. CHLORINATION

Pre ____________________

____

Post ____________________

____

Exhaust Fan ____________________

____

____

Ammonia ____________________

____

____

M. CHLORINATION (Continued)

Cross Connection ____________________

____

Separate Room ____________________

____

N. CHEMICAL FEEDERS

TYPE	NUMBER	OPERATING CONDITION	POINT OF APPLICATION
Lime			
Alum			
Soda Ash			
Carbon			
Fluoride			
Other			

O. PLANT HOUSEKEEPING

Chemical Storage Room ____________________

____

____

Laboratory ____________________

____

____

Filter Area ____________________

____

____

Pipe Gallery ____________________

____

____

Plant Grounds ____________________

____

____

P. MASTER METER

Operating Condition ____________________

____

____

Q. LABORATORY

Chlorine and pH Test Kit ____________________

____

Other ____________________

____

R. RECORDS

Monthly Operating Reports ____________

____

Chlorine and pH Test ____________

____

Bacteriological ____________

____

Maintenance ____________

____

____

S. BACKWASH PUMP

Operating Condition ____________

____

____

____

____

T. STORAGE

Capacity ____________

____

Overflow ____________

____

Drain ____________

____

Covered ____________

U. OPERATORS CERTIFIED

NAME	CLASS

V. WATER SAMPLES COLLECTED

Chemical ____________

Bacteriological ____________

- -

W. RECOMMENDATIONS

____

Signature - Engineer

APPENDIX F

Report of a Survey of the Kentucky State Department of Health Central Laboratory

The equipment and procedures employed in the bacteriological analyses of water by this laboratory conformed with the provisions of Standard Methods for the Examination of Water and Wastewater (13th edition - 1971) and with the provisions of the Public Health Service Drinking Water Standards, except for the items marked with a cross"X" on the accompanying form EPA-103 (Rev. 3-71). Items marked with a "U" could not be determined at the time of the survey. Items marked "O" do not apply to the procedures programmed in this laboratory. Specific deviations are described with appropriate remedial action for compliance in the following recommendations:

Item 4 Transportation and Storage

It is recommended that complete and accurate data accompany each sample received by the laboratory. The data should plainly state the source of the water supply, the exact location sampled, the chlorine residual found at the time of sampling, and the time of day. Any special conditions that may suggest contamination should be noted so that the laboratory personnel can make proper dilutions to cover the range of expected bacterial concentration. Information accompanying each sample may also be an important aid in interpretation of results. The identification of some water

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Item 32 Buffered Dilution Water

A fresh stock buffer solution should be prepared if the turbidity indicates biological growth in the stock solution. This turbidity may result from contamination by many different kinds of organisms, either fungal or bacterial by nature. These organisms are capable of survival and growth in the presence of the minimal concentrations of nutrients found in buffered dilution water. Microbiological analysis of contaminated stock buffer solution generally shows large numbers of Pseudomonas and Achromobacter species. Once species of Pseudomonas have gained entry and begin to multiply in dilution water, their antagonistic action toward other organisms may be a source of laboratory concern.

It is suggested that 25 to 30-ml portions of freshly prepared stock buffer solution be dispensed in screw-cap test tubes, sterilized either by MF filtration or by 15 minutes at 121°C, then stored at 5-10°C. Then sterile stock buffer quantities would be available as needed, with a reduced risk or chance contamination from repeated new exposures during quantity withdrawals inherent to larger volume stock supplies.

Item 33 pH Measurements

The pH of all batches of culture media should be checked after sterilization and the pH of each batch recorded with the date and medium lot number. By monitoring final medium pH, a check can be made on possible errors in weighing, excessive heating and sterilization resulting in lactose hydrolysis, chemical contamination or deterioration of ingredients that might occur during storage after stock packages are opened.

Item 35 Storage

The culture media should be protected from strong light. It is especially necessary to protect brilliant green lactose bile broth from strong daylight, sunlight, or fluorescent light since the brilliant green may be decomposed. This decomposition will significantly reduce the suppressive action of BG to non-coliform organisms in the confirmatory procedure. It is recommended that sterile batches of liquid media should be discarded after one week and fresh media prepared.

Item 50 MF Procedure

Air bubbles between the membrane and absorbent pad can easily be recognized on M-Endo (MF) medium as colorless (white) spots in the membrane. A membrane with no air bubbles is uniformly pink. To eliminate bubbles, lift the membrane with sterile forceps and re-roll it onto the absorbent pad. Desiccation and death of coliform organisms may occur where air bubbles are formed, which could result in a lower count than is actually present in the volume of sample filtered.

Filtration of the sample should be done by passing the sample through the filter under partial vacuum; however, the vacuum should be applied after the sterile filter has been placed over the porous plate, the matched funnel unit placed over the receptacle, and the sample added to the filtration unit. Applying continuous vacuum during the examination of water samples should be discontinued. This will prevent uneven distribution of organisms over the membrane and accidental breaking of the membrane.

The volume of sample examined with relationship to drinking water quality must conform to a standard sample before the results can be reported as less than 1. The current practice of filtering only 10-ml volumes of potable water and reporting the result as less than 1 should be discontinued. It is recommended that problem waters be resampled when the result obtained from a standard sample is either confluent growth or greater than 200 non-coliform colonies. Large densities of non-coliform organisms can inhibit coliform development. It is further recommended that "resamples" be marked so that they can be easily recognized by the laboratory personnel and the filtration procedure conducted on the "resample" can be modified, e.g., rather than filter one 100-ml volume, filter at least one 50-ml volume or two 25-ml volumes. The minimum volume recognized as a standard sample is 50 ml. Due to large densities of non-coliform organisms which may be observed, it may be necessary to filter four 25-ml volumes or five 10-ml volumes. Untreated water supplies believed to be of potable quality that have a high density of particulate material such as clay, colloidal iron, or algae, or that have an extremely high density of non-coliform bacteria with essentially no coliform present are not suitable for examination by the membrane filter technique. The quantity of water that could be filtered would not be sufficient to measure any coliform that might be present since they would be obscured by these particulates. The multiple-tube procedure is recommended for these classes of samples.

State Water Laboratory Survey Program

Mr. Henry S. McGuire, designated as the State Water Laboratory Survey Officer, conducts a systematic evaluation of county, city, and water-plant laboratories involved in monitoring public water supplies, and establishes and maintains excellent rapport with laboratory personnel. He is also conscientious in updating his knowledge in the field of water bacteriology.

Table 1 is a list of all certified laboratories, showing the date of last survey, certification expiration date, location of laboratory, procedures utilized, and those laboratories associated with interstate carrier water supplies.

Table 1

Certified Laboratories Conducting Water Analyses

Laboratory	Date of Last Survey	Expiration date of certification	Procedure Utilized
Louisville Water Co. Louisville IC*	10/22/70	10/22/71	MPN MF
Newport Water Company Fort Thomas	1/2/71	1/2/72	MF
City of Covington Filter Plant** Ft. Thomas IC	1/3/71	4/3/71	MF
Hardin County Water District #1*** Radcliff	4/2/69	4/2/70	MPN

Table 1 (cont'd.)

Certified Laboratories Conducting Water Analyses

Laboratory	Date of Last Survey	Expiration date of certification	Procedure Utilized
Hopkinsville Water Commission Hopkinsville	1/21/70	1/21/71	MF
Madisonville Water Treatment Plant Madisonville	1/20/70	1/20/71	MF
Kenton County Water District #1 Latonia	1/5/71	1/5/72	MF
Lexington Water Co. Richmond Rd. Plant Lexington IC	2/25/70	2/25/71	MF
Lexington Water Co. River Station Lexington IC	2/25/70	2/25/71	MF
Ashland Water Treatment Plant Ashland	4/15/71	4/15/72	MPN
Paducah Water Works Paducah IC	4/23/71	4/23/72	MPN
Frankfort Water & Electric Board Frankfort	2/27/70	2/27/71	MPN MF
City of Corbin Water Works Corbin	1/26/71	1/26/72	MPN
Municipal Water & Sewer Dept. Henderson	1/19/70	1/19/71	MPN
Kentucky Water Service Somerset IC	1/25/71	1/25/72	MF

Table 1 (cont'd.)

Certified Laboratories Conducting Water Analyses

Laboratory	Date of Last Survey	Expiration date of certification	Procedure Utilized
Kentucky Water Service Middlesboro	1/27/71	1/27/72	MPN
Central Laboratory Frankfort IC	6/2/71		MF
City of Newport Health Dept. Newport	2/1/71	2/1/72	MF
Louisville-Jefferson County Health Dept. Louisville	10/23/70	10/23/71	MF
Ashland-Boyd County Health Dept. Ashland	3/26/70	3/26/71	MPN
Covington-Kenton Co. Health Dept. Covington	1/4/71	1/4/72	MF
Paducah Branch Laboratory Paducah	2/12/70	2/12/71	MF
Lexington-Fayette Co. Health Dept. Lexington	2/25/71	2/25/72	MF
Bowling Green-Warren Co. Health Dept. Bowling Green	1/22/70	1/22/71	MF

* IC Laboratories associated with Interstate Carrier Water Supplies

** City of Covington Filter Plant is on provisional approval

*** Hardin County Water District #1 is off the approved list

Remarks

A resampling program is initiated whenever an unsatisfactory sample is reported to the Division of Sanitary Engineering; however, the duration of the resampling program is not in compliance with recommendations outlined in the Surgeon General's memorandum to all State Health Officers, dated February 15, 1963.

The resampling program initiated by the State Division of Sanitary Engineering does require that three additional samples be obtained when the original sample is unsatisfactory; however, the additional samples are taken in one day and not on consecutive days. Furthermore, these additional samples may be obtained either from only one location, the sampling location from which the original samples was taken and shown to be unsatisfactory, or one of the additional samples may be taken from this location and the other two taken from locations in the distribution system above and below the sampling location from which the original sample was taken and shown to be unsatisfactory. Any sampling location from which a sample is taken and and shown to be unsatisfactory should be resampled for at least two consective days or until the resamples show that the quality of water at this location is satisfactory. The resampling program should be made in conjunction with a program to locate and correct the cause of contamination.

The accuracy of all laboratory thermometers used to measure temperatures in water samples, water baths, and incubators should be verified. Verification of accuracy should be made at selected temperatures within the minimum and maximum range of intended use by comparison with the readings on a thermometer certified by the National Bureau of Standards or one of equivalent accuracy. Thermometers should be rechecked periodically to ensure their accuracy. It is recommended that bi-metallic thermometers be verified for accuracy quarterly rather than annually or bi-annually.

The E.M.B. agar of Holt-Harris and Teague for the isolation of intestinal pathogenic bacteria should not be used in water bacteriology. This medium contains saccharose in addition to lactose, which could result in a significant increase in non-coliform organisms appearing as colonies on this type of E.M.B. agar. In the event that the laboratory would have an occasion to use E.M.B. agar in water bacteriology, it is recommended that Levine E.M.B. agar be requested from central supply.

The Laboratory Division personnel are concerned regarding the mailing and distribution of sample bottles to the various municipal water plants throughout the State which collect and mail potable water samples to the Central Laboratory in Frankfort for examination. The current procedure is for the Central Laboratory in Frankfort to mail sample bottles to each of the various municipal public water supply plants, which total approximately 300. The Laboratory Division personnel are of the opinion that if the sample bottles were sent to the County Health Departments for distribution not only to private individuals, but especially to the various municipal public water supply plants, better control would be maintained over the distribution of sample bottles. This would also reduce the workload of the Central Laboratory by having to mail sample bottles to only 120 County Health Departments rather than preparing and mailing approximately 300 separate packages containing the required number of sample bottles for each municipal water supply plant. It appears that such a modification of sample bottle distribution would allow more time for the Laboratory Division personnel to examine other than routine samples and permit better control of the distribution of sample bottles within the County itself.

Personnel Approved

Mrs. Adaline Klayer, Supervisor of Laboratory; Mrs. Lorna Oerther, Technician II; and Mr. Greg Crane, Technician I, are approved for the application of the total coliform membrane filter procedure to the bacteriological examination of drinking waters, and the total and fecal coliform membrane filter procedure to the bacteriological examination of stream and natural bathing water quality measurements.

Conclusions

The procedures and equipment in use at the time of the survey complied in general with the provisions of Standard Methods for the Examination of Water and Wastewater (13th edition-1971) and the Public Health Service Drinking Water Standards, and with correction of deviations listed, it is recommended that the results be accepted for the bacterial examination of waters under interstate regulations.

Harry D. Nash

Harry D. Nash
Microbiologist

Report of a Survey of the
Newport Water Filtration Plant
at
2055 Memorial Parkway
Fort Thomas, Kentucky 41075
on June 7, 1971

by

Harry D. Nash, Microbiologist
Water Hygiene Division
Office of Water Programs
Environmental Protection Agency
5555 Ridge Avenue
Cincinnati, Ohio 45213

The equipment and procedures employed in the bacteriological analyses of water by this laboratory conformed with the provisions of Standard Methods for the Examination of Water and Wastewater (13th edition - 1971) and with the provisions of the Public Health Service Drinking Water Standards, except for the items marked with a cross "X" on the accompanying form EPA-103 (Rev. 3-71). Items marked with a "U" could not be determined at the time of the survey. Items marked "O" do not apply to the procedures programmed in this laboratory. Specific deviations are described with appropriate remedial action for compliance in the following recommendations:

Recommendations

Item 23 Pipets

Some of the 10-ml pipets, especially Kimble EXAX brand which are not made of borosilicate glass, are badly etched making it difficult to accurately interpret measured amounts. This type of glass formulation is also more susceptible to etching during cleaning. It is recommended that badly etched pipets should be discarded and replaced with those made of borosilicate glass.

Item 24 Pipet Containers

Metal boxes are recommended for sterilization and storage of sterile pipets. The metal boxes may be made of stainless steel or other non-corrosive, heat resistant metal. Metal boxes of stainless steel resist heat and last longer than those constructed of aluminum although such heat resistant metal may be used; neither copper cans nor boxes should be used as pipet containers because of particles of oxidized copper that may be introduced via pipets into samples or media.

Item 33 pH Measurements

The pH of all batches of culture media should be checked after sterilization or heating and the pH of each batch recorded with the date and medium lot number. By monitoring final medium pH, a check can be made on possible errors in weighing, excessive heating, and sterilization resulting in lactose hydrolysis, chemical contamination or deterioration of ingredients that might occur during storage after stock packages are opened.

Item 50 MF Procedure

The volume of sample filtered should be accurately measured using either sterile pipets, graduated cylinders, accurately marked sample bottles or funnels which have been calibrated. After the sample has passed through the membrane, the funnel should be rinsed not less than three separate times with 20 to 30-ml volumes of sterile buffered dilution water. This procedure flushes all droplets of a sample from thefunnel walls to the membrane filter; extensive testing has verified that proper rinsing with sterile buffered dilution water prevents bacterial retention by the funnel walls.

Air bubbles between the membrane and absorbent pad can easily be recognized on M-Endo (MF) medium as colorless (white) spots in the membrane. A membrane with no air bubbles is uniformly pink. To eliminate bubbles, lift the membrane with sterile forceps and re-roll it onto the absorbent pad. Dissication and death of coliform organisms may occur where air bubbles are formed which could result in a lower count than is actually present in the volume of sample filtered.

Remarks

When sample volumes of less than 20 ml are filtered, it is recommended to pour approximately 20 ml of sterile buffered dilution water into the filtration assembly and then measure the sample into the sterile buffered dilution water. This assures better distribution of organisms over the membrane.

Personnel Approved

Mr. Frank Ball, Director of Water Works and Mr. Henry J. Flynn, Chemist and Microbiologist, are approved for the application of the total coliform membrane filter procedure to the bacteriological examination of drinking water.

Conclusions

The procedures and equipment in use at the time of the survey complied in general with the provisions of Standard Methods for the Examination of Water and Wastewater (13th edition - 1971) and the Public Health Service Drinking Water Standards, and with correction of deviations listed, it is recommended that the results be accepted for the bacterial examination of waters under interstate regulations.

Harry D. Nash

Harry D. Nash
Microbiologist

Report of a Survey of the
City of Covington Water Treatment Plant

The equipment and procedures employed in the bacteriological analyses of water by this laboratory conformed with the provisions of Standard Methods for the Examination of Water and Wastewater (13th edition-1971) and with the provisions of the Public Health Service Drinking Water Standards, except for the items marked with a cross "X" on the accompanying form EPA-103 (Rev. 3-71). Items marked with a "U" could not be determined at the time of the survey. Items marked with an "O" do not apply to the procedures programmed in this laboratory. Specific deviations are described with appropriate remedial action for compliance in the following recommendations:

Recommendations

Item 15 Microscope and lamp

A typical coliform colony has a pink to dark red color with a metallic surface sheen. The sheen area can vary in size from a small pinhead to complete coverage of the colony surface. Membranes are best counted with a magnification of 10 to 15 diameters with a light source adjusted to give maximum sheen appearance. A binocular wide-field dissecting microscope is recommended as the best optical system. A fluorescent light is recommended; this may be a microscope lamp consisting of two [illegible]-watt daylight tubes mounted on a flexible arm supported by a heavy cast base, or the larger but somewhat more cumbersome fluorescent desk lamp.

Item 24 Pipet containers

Metal boxes are recommended for sterilization and storage of sterile pipets. The metal boxes may be made of stainless steel or other non-corrosive, heat-resistant metal. Metal boxes of stainless steel resist heat and last longer than those constructed of aluminum although such heat-resistant metal may be used; neither copper cans nor boxes should be used as pipet containers because of particles of oxidized copper that may be introduced via pipets to sample or media.

Item 29 Cleaning glassware

All laboratory glassware is washed by hand, using Joy liquid detergent which is a mild compound developed for household use and will not remove films of bacterial growth or chemical deposits found in test tubes, pipets, and other laboratory equipment. The use of products specifically formulated for cleaning laboratory glassware is recommended. Glassware should be washed in hot water (160 to 170°F) with several rinses of clean water at the same temperature and a final rinse with distilled water to assure complete removal of the washing compound.

Item 34 Sterilization of media

It is recommended that broths containing carbohydrates be sterilized at 121°C for 10 to 12 minutes. Excessive exposure of lactose and other sugars may result in hydrolysis. Lactose hydrolysis results in glucose and galactose formation. Since there are many non-coliform organisms that can ferment glucose, the use of hydrolyzed lactose broth can result in an increase of false-positive reactions.

Item 35 Storage

The culture media should be protected from strong light. It is especially necessary to protect brilliant green lactose bile broth from strong daylight, sunlight or fluorescent light since the brilliant green may be decomposed.

Liquid media in fermentation tubes, stored at refrigeration or even moderately low temperatures, can dissolve sufficient air to produce a bubble of air in the tube when incubated at 35°C. It is necessary, therefore, that such stored media be incubated overnight before use, and all tubes containing air must be discarded. Fermentation tubes may be stored at approximately 25°C; however, evaporation can proceed at a rapid rate, resulting in significant changes in concentration of the ingredients. Storage at this temperature, therefore, should not exceed a one-week period. It is recommended that all culture media should be prepared in batches of such size that it will all be used in less than one week.

Item 39 Eosin methylene blue agar

The eosin methylene blue agar of Holt-Harris and Teague, used for isolation of intestinal pathogenic bacteria, should not be used in water bacteriology. This medium contains sucrose in addition to lactose, which could result in a significant increase in non-coliform colonies. Levine EMB agar is recommended for confirmation or isolation of coliform bacteria in water bacteriology.

Item 46 Presumptive procedure (shaking sample)

Each sample should be shaken before examination whether the entire volume of sample or only an aliquot is examined. Bacteria may have adsorbed to the surface of particles that may have settled out during standing, or small aggregates of bacteria may be present in the sample; therefore, shaking is necessary to assure an even distribution of the bacteria throughout the entire sample

Item 51 Incubation

Membrane cultures should be incubated in an inverted position to prevent water formed by condensation from dropping down onto the membrane surface, which could result in confluent growth rather than isolated colonies.

Item 60 Physical facilities

The laboratory physical facilities are in need of immediate repair. The area around the faucets at one sink has completely deteriorated, exposing the pipes. The bench surfaces are scarred and uneven, making it difficult to clean and to disinfect the area used for bacteriological examinations. There is need for more adequate cabinet, drawer, and shelf space for the protection of glassware, apparatus, and other material, especially when sterilized equipment and materials are stored. The physical condition of the laboratory certainly justifies the current provisional status, and repairs and remodeling should be initiated to prevent the necessity of placing the laboratory on a disapproved status.

Remarks

Bids will be let July 8, 1971, in order to contract for remodeling the entire laboratory. Remodeling is to begin within ten days after a contractor has been chosen, and the entire remodeling is scheduled to be completed by September 1971.

Personnel approved

Mr. Clarence Cawood, Chemist, is approved for the application of the total coliform membrane filter procedure to the bacteriological examination of drinking water.

Conclusions

The procedures and equipment in use at the time of the survey complied in general with the provisions of Standard Methods for the Examination of Water and Wastewater (13th edition-1971) and the Public Health Service Drinking Water Standards; however, due to the unsatisfactory condition of the laboratory facilities, provisional acceptance of results is recommended pending correction of deviations listed and remodeling of the laboratory. When all deviations are corrected and remodeling is completed, a letter should be written to the State Water Laboratory Survey Officer requesting a date for resurvey. It is recommended that the resurvey be completed within six months of the date of this report.

Harry D. Nash

Harry D. Nash
Microbiologist

Report of a Survey of the
Kentucky Water Service, Inc.

The equipment and procedures employed in the bacteriological analyses of water by this laboratory conformed with the provisions of Standard Methods for the Examination of Water and Wastewater (13th edition-1971) and with the provisions of the Public Health Service Drinking Water Standards, except for the items marked with a cross "X" on the accompanying form EPA-103 (Rev. 3-71). Items marked with a "U" could not be determined at the time of the survey. Items marked "O" do not apply to the procedures programmed in this laboratory. Specific deviations are described with appropriate remedial action for compliance in the following recommendations:

Recommendations

Item 29 Cleaning glassware

All laboratory glassware is washed by hand, using Joy liquid detergent which is a mild compound developed for household use and will not remove films of bacterial growth or chemical deposits found in test tubes, pipets, and other laboratory equipment. The use of products specifically formulated for cleaning laboratory glassware is recommended. Glassware should be washed in hot water (160° to 170°F) with several rinses of clean water at the same temperature, and a final rinse with distilled water to assure complete removal of the washing compound.

Item 31 Laboratory Water Quality

The distilled water used in this laboratory is obtained from the Kentucky Water Service, Inc., Laboratory in Somerset, Kentucky. The Central Laboratory in Frankfort conducts a suitability test on the distilled water. Distilled water, however, should not be stored in plastic bottles for extended periods of time without having another suitability test conducted; borosilicate glassware is recommended for storing distilled water.

During this survey, the Middlesboro Laboratory exhausted its supply of distilled water and purchased some that was commercially prepared. Many of the commercial supplies of distilled water are produced in copper stills, resulting in a product too toxic for microbiological use. All distilled water used for bacteriological testing must be free of both inorganic and organic substances, either toxic or nutritive, which can influence either survival or growth of bacteria. Many factors can influence the quality of distilled water: (1) design of the distillation equipment; (2) source of raw water; (3) condition of the deionizing column; (4) use of a carbon filter; (5) storage chamber for reserve supply; and (6) temperature of stored supply and duration of storage before use. These factors can contribute varying degrees of contaminants from metal ions, ammonium hydroxide, hydrochloric acid, chlorine from the source water, to carbon dioxide from the air. The degree of contamination resulting from one or all of the above factors can differ with the commercial brand and/or with the various batches of the same brand. In order to have a sufficient supply of high quality distilled water for use in preparing media and cleaning glassware, it is recommended that suitable distillation equipment (glass, stainless steel or tin lined) be purchased as soon as funds are available.

Item 35 Storage

Liquid media in fermentation tubes, stored at refrigeration or even moderately low temperatures, can dissolve sufficient air to produce a bubble of air in the tube upon incubation at 35°C. It is, therefore, necessary that such stored media be incubated overnight before use and all tubes containing air must be discarded. Fermentation tubes may be stored at approximately 25°C; however, evaporation can proceed at a rapid rate, resulting in significant changes in concentration of the ingredients. Storage at this temperature, therefore, should not exceed a one-week period. It is recommended that all culture media should be prepared in batches of such size that it will all be used in less than one week.

Item 37 Lauryl tryptose broth

An error was made in preparing the double-strength lauryl tryptose broth from approximately the middle of February 1970 to the time of this survey. Instead of using 71.2 grams of dehydrated medium per liter of water, the same quantity was added to only 500 ml of water, resulting in quadruple rather than double strength medium. Basically this alters the medium by the fact that it becomes a selective medium, not necessarily for coliforms, rather than an enrichment medium. The data obtained during the period of time the quantity of dehydrated medium was miscalculated is questionable and should not be used as official data.

Item 46 Presumptive procedure

Misinterpretation of what constitutes a positive presumptive test must be corrected. If gas in any quantity is present in the inverted vial, the test should be recorded as a positive presumptive test and should be confirmed by transferring a loopful of the culture to brilliant green lactose bile broth. Reporting a single bubble in the presumptive test as negative and then confirming in the brilliant green lactose bile broth should be discontinued and all tubes showing any amount of gas in the presumptive test should be reported as positive. The interpretation of a positive presumptive and confirmed test is the presence or absence of gas, not an amount produced. Gas produced by fermentation will always be accompanied by turbidity of the medium. This is why media stored at low temperatures must be incubated before use to verify that gas which may be present has not resulted from air dissolved in the medium at low temperatures and released as the medium has increased in temperature. Gas observed as a result of dissolved air at low temperatures will not be accompanied by turbidity of the medium.

Item 48 Completed test

The confirmed test can yield positive reactions in the absence of the coliform group (false-positive test). Therefore, it is necessary to establish the validity of the confirmed test by comparison with the completed test. The number of comparative procedures for establishing the confirmed test for use in water quality examinations by comparison with the completed test depends on the waters examined. The completed test is the reference standard.

Remarks

Although the laboratory is presently equipped to examine potable water by the membrane filter technique, it is recommended that all personnel involved in bacteriological examination of water, attend a Taft Center Training Course on MF procedures or participate for several days in an on-the-job training program at the State Water Laboratory in order to learn approved techniques and procedures. It is further recommended that when the membrane filter procedure is used in this laboratory, parallel testing by the multiple tube fermentation technique be conducted in order to demonstrate applicability and to familiarize the workers with the procedures involved.

Personnel approved

Mr. Charles Spurlock, Plant Operator, is approved for the application of the total coliform multiple-tube fermentation procedure to the bacteriological examination of drinking waters.

Conclusions

The procedures and equipment in use at the time of the survey complied in general with the provisions of Standard Methods for the Examination of Water and Wastewater (13th edition-1971) and the Public Health Service Drinking Water Standards. However, all data developed from the multiple tube procedure during the period of time that the incorrect concentration of lauryl tryptose broth was used should be marked 'void' and stricken from the plant records and those submitted to the Division of Sanitary Engineering since there is no assurance that coliform bacteria were not present in the lauryl tryptose broth that was erroneously prepared. Since this deviation was corrected during this survey and with correction of other deviations listed, it is recommended that all other results be accepted for the bacterial examination of waters under interstate regulations.

Harry D. Nash

Harry D. Nash
Microbiologist

APPENDIX G

Report of a Survey of the Commonwealth of Kentucky Department of Health Division of Laboratory Services

275 East Main Street
Frankfort, Kentucky 40601

by
Earl F. McFarren, Chief
Analytical Quality Control
Water Hygiene Division

The Chemistry Section of the Kentucky State Department of Health is divided into three units; analytical chemistry, biochemistry, and instrumentation. The Chemistry Section is under the direction of Mr. Cecil Webb, Director and Dr. William A. Mappus, Àssistant Supervisor. Most of the drinking water analysis is done by Mr. Gordon Feldhaus, Senior Chemist in the analytical chemistry unit. Dr. Mappus spends most of his time in the anlaysis of narcotic and dangerous drugs, and in court.

In addition to drinking water and drug analyses, the Chemistry Section also does food analysis, pesticide analysis and provides, at least, some support to the air pollution, water pollution, and occupational health programs. Occupational Health, Air Pollution, and Water Pollution also have some of their own chemists and laboratories not under the supervision of the Chemistry Section. Mr. Mercer Peters, Chief Chemist, Water Pollution Control Commission, occasionally runs cyanide and arsenic for the drinking water (sanitary engineering) program when requested.

Another laboratory section that provides occasional service on drinking water is the Radiological Health Program. All radiochemistry is done by Mr. David Clark, Radiation Physicist. In 1970, Mr. Clark analyzed 148 water samples for the Division of Sanitary Engineering. So far this year, no drinking water samples have been analyzed because Mr. Clark's services have been directed to another Radiological Health problem - licensing of physicians to use radioisotopes.

The surveillance and monitoring of drinking water in Kentucky is the responsibility of the Division of Sanitary Engineering, headed by Mr. Nick G. Johnson. Mr. Johnson has three programs under his direction, namely, Public Water Supply, Public Swimming Pools, and Plumbing. There are only four engineers on the entire staff. In fact, a number of engineering positions in the Division of Sanitary Engineering have been abolished during the last few years.

Water Chemistry

There are about 423 public water supplies in the State. These are composed of 270 municipal water supplies, 124 water districts, and 29 public parks. About 109 of these supplies serve a population of over 3,000, and hence by law are required to fluoridate.

The records of the Chemistry Section indicate that about 420 water supplies were analyzed last year for, in most cases, fifteen substances on a routine basis. Only ten of these are required by the Drinking Water Standards, and therefore, sixteen of the required determinations were not carried out on these samples. Thus, it would appear that most of the public water supplies were checked last year but less than half of the required chemistries were carried out on these. However, there were no records to indicate any systematic procedure for determing when or which water systems were last checked and how often they have been checked. There were more or less complete chemistries (everything except barium, CCE, cyanide, silver and radiochemical) carried out on about 36 water samples last year. This leaves about 386 supplies which were not checked, or for which there are no records to indicate when they were last checked.

Supposedly the 109 fluoridated water supplies are checked twice a month by the health department, however, their records indicate that only 2,079 samples were analyzed last year. Thus, about 25 supplies are either not being checked routinely or perhaps are not fluoridating. In any case, no one seems to be checking on this problem or doing anything about the situation.

Laboratory Equipment

The laboratories are only about eight years old, and in general are well equipped, and spacious. The Chemistry Section has inadequate hood space to carry out all of the extractions required for pesticide, drug, and food analysis and apparently, the existing hoods do not operate entirely satisfactorily due to a deficiency of make-up air.

Compliance with Standard Methods

Of the ten substances required by the Drinking Water Standards which they are running routinely, they are not complying with Standard Methods in the determination of color, nitrates, sulfates, and turbidity (see attached survey form, items 1 and 2). As indicated under item 3, they never do mercury, barium, silver, or CCE and seldom do arsenic, cadium, chromium, copper, lead, selenium, zinc or radiochemistries.

They have a fluoride electrode and its use or the use of the SPADN's procedure would be preferable to the use of the alizarin method which they are using. They also have an atomic absorption spectrophotometer which is being used only for sodium and potassium analysis. It was recommended that their Beckman Du be set up to run sodium and potassium by flame emission so that their atomic absorption spectrophotometer could be used for analysis of the other metals which are not being done by wet chemistry.

Conclusions

Only 10 out of 26 substances specified in the Drinking Water Standards are being run routinely.

Non-standard methods are being used for the determination of color, nitrates, sulfates and turbidity.

There is inadequate hood space available in the laboratory and the hoods already there are not functioning properly.

Sample identification forms have no place to indicate the exact sampling site (see item 33B of survey form). This is particularly important in the collection of distribution samples.

The laboratory does not have any sort of an internal quality control program (see item 40).

Since samples may not always be analyzed within 72 hours, sample preservation should be considered (see item 31). If nitrates cannot be preserved with mercuric chloride, they should be, at least, refrigerated until analyzed, as should the methylene active substances sample if this analysis is done. If metal analysis is undertaken on a routine basis, the sample should be preserved with nitric acid and new disposable cubitainers (item 30) should be used rather than reusable containers, particularly in the case of mercury, iron, and silver analysis.

The present staff is inadequate to handle the required additional metal analysis and radiochemistries.

The Water Supply Program has an excellent file (by county) of the water supplies analyzed and for what constituents are analyzed. However, the data has not been summarized in any way since 1960 and it is practically impossible to determine which or when each supply was last checked, if any problems existed and if so, if any follow-up program was instigated.

The fluoride content of each public water supply over 3,000 is supposedly checked twice each month, but the records of analysis indicate that either all of the supplies are not fluoridating or are not being checked regularly because of the lack of an adequate follow-up program.

No distribution sampling is being done.

Recommendations

It is recommended that additional personnel (2 or 3 chemists) be hired to carry out the required metal analysis and radiochemical analyses.

Additional staff is also needed by the water supply program in order to maintain a more detailed and up-to-date record keeping system to assure that all supplies are being checked at regular intervals and to handle any problems discovered. This undoubtedly will require the hiring of an additional engineer, a clerk and perhaps a computer programmer,and renting computer time.

A Hach Model 2100A Turbidimeter should be purchased for turbidimetric measurements and Standard Methods should also be adopted for the analysis of nitrates and sulfates.

A laboratory quality control program should be instigated.

The use of disposable plastic bottles for sample collection (particularly, if metal analysis is requested) and the use of preservatives to stabilize the samples is also recommended.

If certification of this laboratory is desired, in order to accept their results on analysis of interstate carrier water supplies, it is recommended that they be required to demonstrate their capability by analyzing check samples obtained from this laboratory at least once each year.

SURVEY OF WATER CHEMISTRY LABORATORIES

ENVIRONMENTAL PROTECTION AGENCY
Water Quality Office
Water Hygiene Division

Indicating conformity with the 13th edition of Standard Methods for the Examination of Water and Wastewater (1971).

Survey by Earl F. McFarren
May 20-21, 1971

X = Deviation U = Undetermined
O = Not Used

Laboratory Kentucky Dept. of Health
Director Dr. B. F. Brown
Street 275 Main Street
Chief Chemist Cecil Webb
City Frankfort State Kentucky
Water Supply Chief Nick Johnson

Substances Determined

1. Physical determinations	Method	
a. color	describe color, don't measure	X
b. odor	self evaluation	X
c. turbidity	Spectronic 20, Hack procedure	X

2. Miscellaneous anions, organics and solids		
a. chlorides	mercuric nitrate titration	
b. cyanide	titration, not done routinely	
c. carbon chloroform extract		0
d. fluorides	alizarin visual method	
e. nitrates	Hach brucine sulfate	X
f. sulfates	Hach turbidimetric	X
g. surfactants	methylene blue, not done routinely	
h. total dissolved solids	evaporation at 103°C	
i. uranyl ion		

3. Metals		
a. arsenic	Gutzeit, not done routinely	
b. barium		0
c. boron		
d. cadmium	dithizone, not done routinely	
e. chromium	diphenyl carbazide, not done routinely	
f. copper	cuprethol, not done routinely	
g. iron	ortho-phenanthroline	
h. lead	dithizone, not done routinely	
i. manganese	persulfate	
j. selenium	diaminobenzidine, not done routinely	
k. silver		0
l. mercury		0
m. zinc	dithizone, not done routinely	

4. Radioactivity

a. gross beta not done routinely
b. radium 226 barium precipitation, not done routinely
c. strontium 90 carbonate precipitation, not done routinely
d. other

5. Pesticides

a. aldrin analyze 5 or 10 drinking water samples
b. chlordane for chlorinated hydrocarbon pesticides
c. dieldrin on request per year
d. DDT
e. endrin
f. heptachlor
g. heptachlor epoxide
h. methoxychlor
i. lindane
j. toxaphene
k. total organic phosphates plus carbamates
l. chlorinated phenoxy alkyl pesticides
m. other

Laboratory Apparatus

	Make	Model
6. Filter photometer	B & L	Spectronic 20
7. Spectrophotometer	Perkin-Elmer	356
a. visible	Beckman	Du
b. flame	Beckman	Du
c. other		
8. Atomic absorption spectrophotometer		
a. air-acetylene burner	Perkin-Elmer	303
b. nitrous-oxide burner	" "	"
c. cold vapor (flameless)	" "	"
9. Gas chromatographic equipment		
a. electron capture	Varian	600B
b. flame ionization	Beckman	GC-5
c. flame photometric		
d. microcoulometric		
e. other	Perkin-Elmer	154

Laboratory	Location	Date

	Make	Model	
10. Other chromatographic equipment			
a. thin-layer	have		
b. Kuderna-Danish evaporator	have		
c. other			
11. Turbidimeter			
12. Amperometer			
13. Titrimeter			
14. pH meter	Beckman Zeromatic, Coleman Model 12		
15. Fluoride electrode	Orion, not used		
16. Arsine generator	Water pollution runs for them		
17. Cyanide still			
18. Fluoride still			0
19. Carbon-chloroform extraction equipment			
a. high or low flow columns			
b. carbon drying oven			
c. extraction apparatus	have one, never used		
d. manifold for solvent evaporation			
20. Drying oven	have		
21. Steam bath	have		
22. Hot water bath	have		
23. Muffle furnace	have		
24. Distilled water still	four, 10 gal per hr		
25. Water deionizer	large mixed bed, central source		
26. Conductivity meter	have		
27. Balance, sensitive to 0.1 mg	Satorius, Mettler		
28. Automatic analyzer for			
a. glucose		Technicon	
b. fluoride (not used for water)		Technicon	

	Make	Model	
28. Automatic analyzer for (Continued)			
c.			
d.			
e.			
f.			
29. Other instruments or equipment			
a.	Infra-red, Perkin-Elmer	221	
b.	X-ray defraction G.E.	XR-D5	
c.	Emmission Spectrograph	B & L	
d.	Low-temperature asher		

Samples

30. Containers

- a. Non-reusable plastic containers preferred for the collection of samples for general inorganic analysis. X
- b. Glass bottles with teflon lined caps preferred for collection of pesticide samples . . . . ____
- c. other kind . . . . ____

31. Preservatives

- a. Samples for metal analysis preserved by the addition of nitric acid to a pH of about 2.0 0
- b. Nitrates and methylene blue active substances preserved by addition of mercuric chloride 0
- c. Cyanide preserved by the addition of sodium hydroxide to a pH of 11. . . . . ____
- d. No known or required preservative for turbidity, color, pH, chloride, sulfate, fluoride, specific conductance and total dissolved solids. . . . . ____
- e. If no preservative is used, in general samples are analyzed within 72 hrs . . . . ____

32. Frequency

- a. Physical characteristics measured at least once a week and preferably every day at the treatment plant X
- b. Chemical characteristics determined at least once every three years and preferably semi-annually unless previous data has indicated a potential problem which needs to be monitored more frequently. X

Laboratory Location Date

33. Identification

a. Every bottle should be identified by attaching an appropriately inscribed tag, a label or a number corresponding to a sample identification sheet. . . . . ____

b. The minimum information required on the tag or correspondingly numbered sheet includes; name of the water supply sampled, location of sampling site, exact date and time of collection, type of sample (raw, finished, grab or composite) and by whom collected . . . . . no place for site. X

34. Collection

a. Samples from wells collected after pumping for a sufficient time to assure that the sample is representative of the ground water which feeds the well. . . . . ____

b. Finished (treated) water sampled at the plant by use of a pipeline drip device or the collecting and compositing of hourly (or other interval) samples . . . . . . ____

c. Distribution samples obtained at several different points in the system; usually grab samples obtained without first flushing the line, although both kinds of samples may at times be desirable. . . . . ____

35. Records

a. Assay results assembled and available for inspection . . . . . . ____

b. Notation made of those water supplies which did not comply with one or more standards, and some sort of follow-up program instigated . . . . ____

c. Evidence that all waters examined at periodic intervals X

36. Number analyzed annually

a. private supplies ____ ____

b. semi-public ____ ____

c. municipal about 415 analyzed for 10 substances ____

(1) sources ____ ____

(2) finished 2079 just for fluorides ____

(3) distribution ____ ____

Miscellaneous

37. Physical facilities
    - a. Bench top area adequate. . . . . ______
    - b. Sufficient cabinet space for chemicals and glassware . . . . ______
    - c. Adequate hood space . . . . __X__
    - d. Office space available for record keeping and processing reports . . . . ______
    - e. Space for storage and handling of bottles . . . . ______

38. Laboratory water quality
    - a. Conductivity of water checked at regular intervals . . . . ______
    - b. Use of deionized water for metal analysis. . . . . ______

39. Glassware
    - a. Thoroughly washed with suitable detergent and warm water . . . . ______
    - b. Rinsed immediately in clean tap water to remove detergent . . . . ______
    - c. Final rinse with distilled water . . . . ______
    - d. Dichromate cleaning solution used for difficult to clean glassware . . . . ______
    - e. Glassware used for pesticide analysis should receive a final rinse with A. R. grade acetone or ethyl acetate . . . . . . ______

40. Controls
    - a. A control sample of known composition (in addition to any necessary standards) is analyzed every time one or more unknown samples are analyzed . . . . __X__
    - b. A control sample is available and used for each substance specified in the drinking water standards . . . . __X__
    - c. A control chart has been constructed for each substance, and the precision of each determination has been calculated . . . . __X__

41. Laboratory evaluation service
    - a. Total number of laboratories examining water __1__ . . . . ______
    - b. Accuracy and ability of each laboratory to perform each analysis checked by the analysis of an unknown control sample at least once a year . . . . ______

42. Personnel
    - a. Total number of staff __1 plus some assistance from others__ . . . . . __X__
    - b. Number with degrees in chemistry______ . . . . ______
    - c. Does state operate under a merit system . . . . ______
    - d. Are job descriptions written. . . . . ______

43. Salaries
    - a. Chief chemist __$13,500__ . . . . ______
    - b. Assistant chemist __$10,000__ . . . . ______
    - c. Aids __4 to 7,000__ . . . . ______

APPENDIX H

WATER-BORNE DISEASE OCCURRENCE

Since the middle of the nineteenth century, when Dr. John Snow did his classical study on the transmission of cholera through a water supply, it has been generally recognized that disease epidemics can, and do, result from consumption of water containing pathogenic microorganisms. Diseases most commonly associated with drinking water are cholera, typhoid fever, dysentery, and infectious hepatitis. Spread of these diseases occurs most commonly when body wastes from the infected persons are ingested. While person-to-person contact is recognized as the common method of transmission for low incidence levels currently found in this country, the potential for catastrophic epidemics transmitted by drinking water supplies which serve thousands of people remains and demands constant vigilance.

In recent years, concern has also been directed to the possible chronic diseases which may result from use of water containing certain chemicals. These potentially dangerous chemicals include heavy metals, pesticides, and other toxic industrial products. Although few clinical cases are recorded, health agency statistics are usually limited to communicable diseases and affected individuals may have unrecognized symptoms. Increased reuse of water by municipal, agricultural, and industrial users indicates vigilance against chemical contamination must be maintained.

Human body wastes from infected person(s), when present in inadequately treated drinking water, have caused waterborne disease outbreaks in

Kentucky. In all, six outbreaks, involving "semi-public" or rural individual water systems, have been reported during the last twenty years which implicated drinking water as the source of disease transmission. Fortunately, none of the outbreaks resulted in a fatality. In the 1950's three outbreaks were reported and involved contaminated well water as the source of disease transmission. The disease outbreaks were 13 cases of typhoid, 13 cases of gastroenteritis, and 9 cases of infectious hepatitis. In 1963, seven persons at a church camp in Fleming County contacted typhoid fever. Epidemiological evidence indicated a sewage contaminated cistern as the cause of the outbreak. In 1964, 115 persons at the Hebron Elementary School in Boone County suffered a severe gastroenteritis attack which was the result of a contaminated water supply cistern. The most recent reported waterborne disease outbreak occurred in 1967 and involved 73 cases of infectious hepatitis at a restaurant in Logan County. The cause of the outbreak was found to be the well water supply which was contaminated by septic tank effluent. In the mid 1950's a significant epidemiological study was conducted by Schliessmann, et.al. in Eastern Kentucky on the relationship of environmental factors and enteric disease. The availability and quality of drinking water was one of the primary environmental considerations. The study aptly demonstrated an increased incidence of enteric disease among study groups with inadequate supplies of drinking water.

While epidemiological records do not generally show widespread incidence of waterborne disease, this may actually reflect incomplete reporting, inaccurate diagnosis and the fact that much enteric illness is not treated by physicians. This had led some authorities to suggest that cases of such diseases as gastroenteritis and infectious hepatitis may actually be as many as 100 times the number reported.

Table I presents a tabulation of significant potentially waterborne diseases and a comparison of the number of cases occurring in Kentucky versus the number occurring nationwide for the past ten years. While Kentucky has approximately 1.6 percent of the nation's population, it has:

(1) 0.3 percent of the total number of reported cases of amebiasis for the period 1961-1970.

(2) 3.1 percent of the total number of reported cases of viral hepatitis for the period 1961-1970.

(3) 0.4 percent of the total number or reported cases of shigellosis for the period 1961-1970.

(4) 2.7 percent of the total number of reported cases of typhoid fever for the period 1961-1970.

(5) 2.3 percent of the total number of reported cases of salmonellosis for the period 1961-1970.

Tables II and III present a comparison of viral hepatitis and typhoid case rates in Kentucky versus the average case rates for the nation.

The data in the Tables are not intended to imply that all reported cases were waterborne. It is intended, however, to point out that

TABLE I

INCIDENCE OF WATER-BORNE DISEASE

Year	Amebiasis	Hepatitis*	Salmonellosis	Shigellosis	Typhoid
1961					
Reported Ky. Cases	19	3,188	315	18	19
Reported U.S. Cases	2,850	72,651	8,542	12,571	814
Percent in Ky.	0.7	4.4	3.7	0.1	2.3
1962					
Reported Ky. Cases	4	2,405	32	18	17
Reported U.S. Cases	3,048	53,016	9,680	12,443	608
Percent in Ky.	0.1	4.5	0.3	0.1	2.8
1963					
Reported Ky. Cases	7	1,158	453	31	14
Reported U.S. Cases	2,886	42,974	15,390	13,009	566
Percent in Ky.	0.2	2.7	3.0	0.3	2.5
1964					
Reported Ky. Cases	10	906	572	57	10
Reported U.S. Cases	3,304	37,740	17,144	12,984	501
Percent in Ky.	0.3	2.4	3.3	0.4	2.0
1965					
Reported Ky. Cases	6	870	180	51	7
Reported U.S. Cases	2,768	33,856	17,161	11,027	454
Percent in Ky.	0.2	2.6	1.1	0.5	1.5
1966					
Reported Ky. Cases	5	951	179	26	10
Reported U.S. Cases	2,921	32,859	16,841	11,888	378
Percent in Ky.	0.2	2.9	1.1	0.2	2.6
1967					
Reported Ky. Cases	5	1,135	1,132	64	25
Reported U.S. Cases	3,157	38,909	18,120	11,474	396
Percent in Ky.	0.2	3.5	6.3	0.5	6.3
1968					
Reported Ky. Cases	3	1,152	516	51	12
Reported U.S. Cases	3,005	45,893	16,514	12,180	395
Percent in Ky.	0.1	2.5	3.1	0.4	3.0
1969					
Reported Ky. Cases	22	1,278	125	78	12
Reported U.S. Cases	2,915	48,416	18,419	11,946	364
Percent in Ky.	0.8	2.6	0.7	0.6	3.3
1970					
Reported Ky. Cases	3	1,271	151	62	6
Reported U.S. Cases	2,888	56,797	22,096	13,845	346
Percent in Ky.	0.1	2.2	0.7	0.4	1.7
Totals					
Reported Ky. Cases	84	14,314	3,655	456	132
Reported U.S. Cases	29,742	463,111	159,907	125,367	4,822
Percent in Ky.	0.3	3.1	2.3	0.4	2.7

***Includes serum hepatitis for years 1961 - 1965**
Source: "Morbidity and Mortality Weekly Reports", Center for Disease Control, Atlanta, Ga.

TABLE II

REPORTED CASES OF VIRAL HEPATITIS

(Infectious and Serum)

Case Rate per 100,000 population

YEAR(FY)	UNITED STATES[1]	KENTUCKY[2]
1953	16.2	30.9
1954	29.3	34.5
1955	23.7	12.4
1956	13.9	18.7
1957	9.8	26.8
1958	8.2	22.3
1959	11.0	43.1
1960	17.4	66.9
1961	35.7	104.8
1962	33.6	79.0
1963	24.4	37.2
1964	21.6	28.7
1965	18.0	27.4
1966	17.1	29.9
1967	19.0	27.9
1968	22.3	36.9
1969	26.2	35.7
1970	29.5	39.5

[1] CDC, Hepatitis Surveillance, 20:9 (Sept. 30, 1967)

[2] Calculation based on population figures contained in Statistical Abstract of the United States 1963 and 1970, U.S. Dept. of Commerce, Bureau of the Census

TABLE III

REPORTED CASES OF TYPHOID FEVER

Case Rate per 100,000 population

YEAR	UNITED STATES[1]	KENTUCKY[2]
1961	0.46	.62
1962	0.33	.56
1963	0.30	.45
1964	0.27	.32
1965	0.23	.22
1966	0.19	.31
1967	0.19	.78
1968	0.19	.37
1969	0.18	.37
1970	0.17	.19

[1] CDC, Morbidity and Mortality Weekly Report, Annual Supplement - Summary 1970, 19(53):30(1971).

[2] Calculation based on population figures contained in Statistical Abstract of the United States 1970, U.S. Dept. of Commerce, Bureau of the Census.

a portion of these cases, plus an unknown number of unreported cases, may have been waterborne. In addition, it is significant to note that body wastes from these diseased persons pose the constant threat of contaminating public drinking water with pathogenic microogranisms.

In essentially all documented cases of waterborne illness, it has been shown that definite deficiencies existed in the water supply systems during the time when disease was transmitted. Furthermore, these deficiencies were either unrecognized because of inadequate surveillance for public health hazards, or were recognized but not remedied due to ineffective persuasion or enforcement by health officials. Deficiencies similar to those believed responsible for epidemics still are found in the water supplies of Kentucky. The requisites for repetition of the tragic epidemics of the past, namely deficient health protection of public water supplies and presence of diseased individuals in the State, are still present in Kentucky. Greater vigilance by health officials and the water supply industry is indicated in order to minimize risk from drinking water supplies.

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